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DRAFT ENVIRONMENTAL IMPACT STATEMENT

South Beal Project

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Prepared by:

Montana Department of State Lands
and
U.S.D.A. Forest Service

March 1993

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Deerlodge National Forest
Box 3840
Butte, MT 59702

Montana Department of
State Lands
Capitol Station
Helena, MT 59620

March 15, 1993

Dear Reader:

Enclosed for your review is a copy of the DRAFT Environmental Impact Statement (EIS) for Beal Mountain Mining Company's proposed South Beal Project. The South Beal Project is the development of two small pits in the German Gulch drainage 16 miles southwest of Butte.

The Montana Department of State Lands (DSL) and the Deerlodge National Forest (DNF) have prepared this EIS for your review. In addition, the agencies are preparing a Biological Assessment pursuant to the Endangered Species Act. This Biological Assessment will contain additional technical information regarding endangered, threatened, and sensitive species and potential mitigations. It should be considered a technical appendix to this document. The Biological Assessment will be attached to the final EIS.

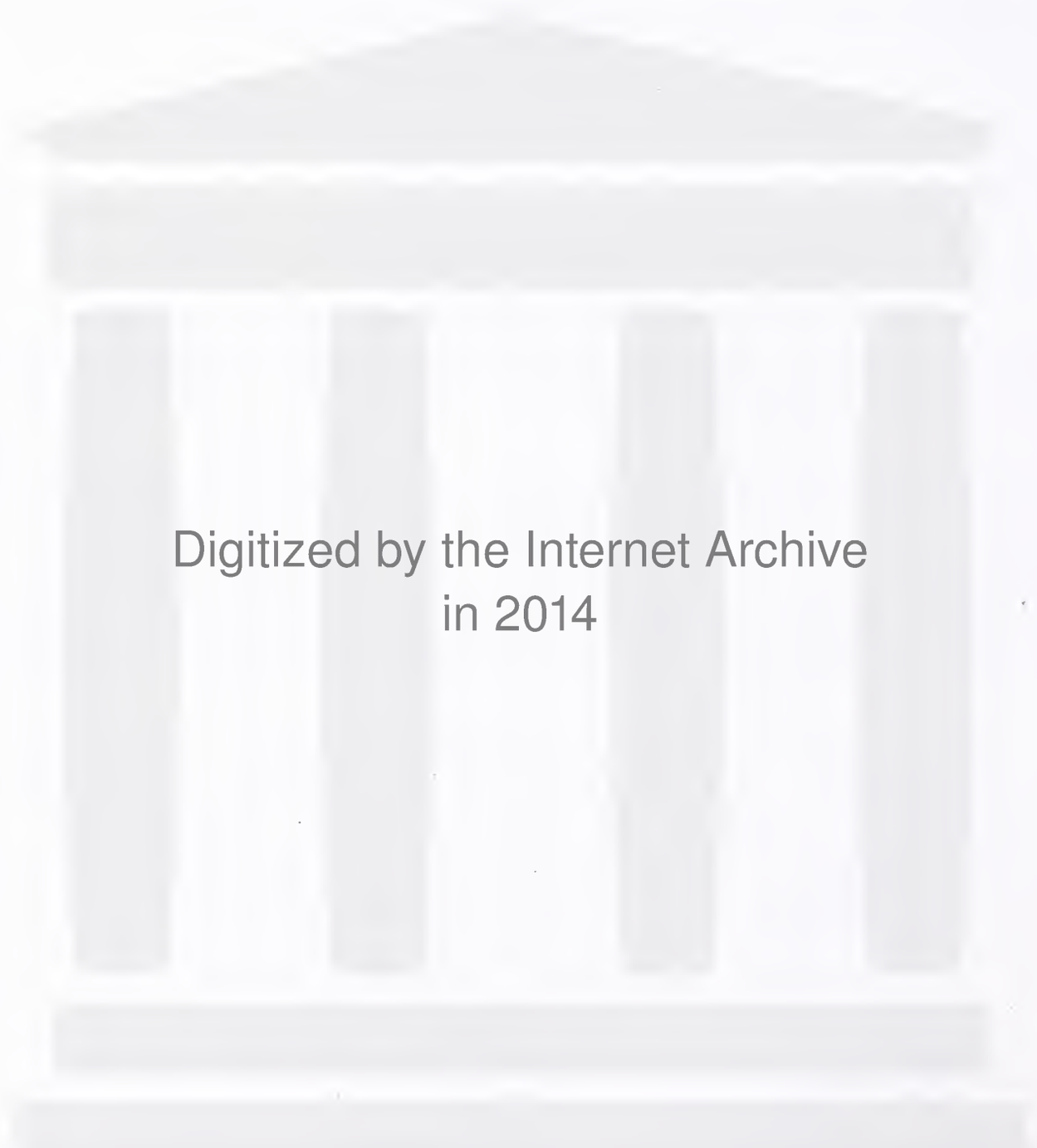
Additional copies are available for comment by contacting the individuals below. The purpose of the written comment period is to provide an opportunity for the public to provide substantive comment on the draft EIS. A public meeting will be held if requested. The agencies want to be sure they have included all the appropriate information in the document, have adequately addressed the concerns raised during scoping, and have not made errors in assumptions and analyses. Therefore, if you have such written comments, please direct them to:

Margaret C Ewing

Margie Ewing
Deerlodge National Forest
Box 3840
Butte, MT 59702
(406)494-2147

M J DaSilva

Mike DaSilva
Montana Department of State Lands
Capitol Station
Helena, MT 59620
(406)444-2074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DRAFT ENVIRONMENTAL IMPACT STATEMENT

South Beal Project

Prepared by:

Montana Department of State Lands
and
U.S.D.A. Forest Service

March 1993

COVER SHEET

Type of Statement

Draft Environmental Impact Statement

Proposed Action

Construction and Operation of South Beal Project

Lead Agencies

Deerlodge National Forest
Montana Department of State Lands

Responsible Officials

Margie Ewing, District Ranger, Deerlodge National Forest, Box 3840, Butte, MT 59701
Bud Clinch, Commissioner of State Lands, Department of State Lands, Capitol Station, Helena, MT 59601

Abstract

The South Beal Environmental Impact Statement (EIS) describes the land, the people, and the resources potentially affected by the approval of the proposed South Beal Project amendment. The major state and federal action is the approval of necessary permits to construct and operate the South Beal Project. The proposed project would consists of two small open pits that would be backfilled and reclaimed after they are mined out. A small section of road would connect the South Beal pits with the existing haul road. Ore would be hauled to the existing heap and waste rock would be hauled to the existing waste rock dump. Three alternatives analyzed in detail in this draft EIS include the proposed action, mitigation of mine-related impacts alternative, and the no action alternative.

Comment Period

This is a draft Environmental Impact Statement, open to public comment and review for 45 days following publication, on March 25, 1993, of the Notice of Availability in the *Federal Register*. Comments should be directed to Mike DaSilva, Montana Department of State Lands, at the address below. Comments should be submitted by May 10, 1993.

Reviewers should provide the Forest Service and DSL with their comments during the review period of the draft environmental impact statement. This will enable the agencies to analyze and respond to the comments at one time and to use information acquired in the preparation of the final environmental impact statement, thus avoiding undue delay in the decisionmaking process. Reviewers have an obligation to structure their participation in the National Environmental Policy Act process so that it is meaningful and alerts the agency to the reviewers' position and contentions. *Vermont Yankee Nuclear Power Corp. v. NRDC,* U.S.519, 553 (1978). Environmental objections that could have been raised at the draft stage may be waived if not raised until after completion of the final EIS. *City of Argoon v. Hodel* (9th Circuit, 1986) and *Wisconsin Heritages, Inc. v. Harris,* 490 F. Supp. 1334, 1338 (E.D. Wis. 1980). Comments on the draft EIS should be specific and should address the adequacy of the statement and the merits of the alternative discussed (40 CFR 1503.3).

For further information contact:

Margie Ewing
Deerlodge National Forest
Box 3840
Butte, MT 59702
(406)494-2147

Mike DaSilva
Montana Department of State Lands
Capitol Station
Helena, MT 59620
(406)444-2074

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SUMMARY

This document summarizes the Draft Environmental Impact Statement (EIS) for the proposed South Beal Project. This summary document cannot contain all the detailed information in the Draft EIS. For a copy of the Draft EIS please contact:

Margie Ewing
Deerlodge National Forest
Box 3840
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(406)494-2147

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THE EIS AND PERMITTING PROCESS FOR THE SOUTH BEAL PROJECT

The South Beal Project is a proposed expansion of the Beal Mountain Mine. The Department of State Lands (DSL) and the Deerlodge National Forest (DNF) are the "lead" government agencies. The DSL and DNF must approve, approve with modifications, or deny the expansion proposal.

The Beal Mountain Mine is a gold and silver mine located in Silver Bow County, Montana, about 16 air miles southwest of Butte. Beal Mountain Mining Incorporated (BMMI), a wholly owned subsidiary of Pegasus Gold Corporation of Spokane, Washington, operates the mine under Operating Permit 00135 from the DSL. The current mine production is about double that originally estimated. The current workforce is 125 workers, approximately double that originally estimated. On August 18, 1992, BMMI submitted an operating permit amendment application. In the amendment it proposes to develop a one million ton gold ore body on the south side of German Gulch, within the existing boundary of Operating Permit 00135, known as the South Beal Project. The disturbed land would be National Forest System land.

The proposal is to develop two small open pits that would be backfilled and reclaimed after they are mined out. Mining would occur during the 1993 and 1994 mining seasons, reclamation would be completed the following year. The total number of acres disturbed by BMMI would increase from 424.8 acres to 450 acres, a net increase of 25.2 acres.

This proposal would extend the life of the Beal Mountain Mine by one year. The proposal is a result of ongoing exploration in the area of the mine. Employment numbers are not expected to change with the development of the South Beal pits. The proposal was determined complete on March 3, 1993. The current reclamation bond total is set at $2,770,000. The bond amount would be adjusted to account for reclamation of the South Beal pits including backfilling and haul road disturbance, if this proposed amendment is approved. The reclamation bond is projected to increase by $400,000 to $500,000 for the proposed disturbances.

The amendment application is on file and available for review at the DSL office at 1625 Eleventh Ave., Helena, Montana 59620, and the DNF office at 1820 Meadowlark, Butte, Montana 59701. The EIS and this summary describe the agencies' analysis of potential environmental consequences of the proposed action and alternatives.

Background

BMMI's original plan of operations and permit were approved by the DSL and the DNF after review and evaluation of its 1988 application. The agencies prepared and distributed an Environmental Assessment (EA) in July 1988. The EA concluded that the Beal Mountain Mine

would have no significant long- or short-term impacts on the German Gulch drainage. BMMI first submitted the South Beal Project application in January 1992. BMMI withdrew the application later. In August 1992, BMMI applied for Amendment #1 to the Operating Permit. Amendment #1 moved the haul road from the north side of German Gulch drainage to the south side. An EA was prepared and DSL approved the road on August 14, 1992. BMMI resubmitted the South Beal application later. The current proposal, if approved, would be the second amendment to the original plan of operations and permit. This EIS incorporates by reference the 1988 EA and 1992 EA which are on file and available from the agencies.

Public Participation

Public participation is an important part of an EIS. The National Environmental Policy Act (NEPA) and the Montana Environmental Policy Act (MEPA) are Federal and State laws which direct the USFS and the DSL to disclose the effects of proposed activities on Federal and State lands to the public and to officials making decisions concerning the proposal.

The DSL and USFS sought public and other agency input to help identify environmental issues and concerns with BMMI's proposal through the process called scoping. Scoping activities for this project included holding a public meeting in Butte, Montana, on February 6, 1992, letters to citizens and groups interested in activities in the project area, and soliciting written comments through an article in the newspaper (MT Standard, January 24, 1992). A legal notice ran in the newspaper for three consecutive weeks. The public comment period was held open until February 21, 1992. In addition to the public meeting and letters, BMMI conducted meetings with local groups to discuss the proposal. A list of all issues and concerns raised in scoping and through the agency review process is presented in the next section of this Summary.

Issues and Concerns Raised in Scoping

Comments received during the scoping period were compiled and reviewed. Interdisciplinary team specialists from the DSL and USFS also raised comments and concerns during the usual review of the application and scoping. All issues are summarized below:

Geology and Engineering

What is the potential for the mine material to produce contaminated leachates? The index of measure will be pH and static and kinetic test results.

Would the South Beal pits be stable? If they fail, would the area to be reclaimed be larger? The indices of measure will be visual observation of pit walls and edges for movement.

Because of operational stability problems in the main Beal pit, would the addition of ore on the heap affect the stability of the heap and/or pit? The indices of measure would be movement recorded by survey of monuments and visual observations of highwall and leach pad areas.

Ground and Surface Water

Would the proposed action affect water quantity? The index of measure will be flow rate. Would the proposed action affect ground and surface water quality in the German Gulch drainage? Specifically, how would the proposed action affect sediments and concentrations of total suspended solids (TSS), total dissolved solids (TDS), nitrate, sulfate, arsenic and other metals? Indices of measure will be concentrations of the parameters listed above.

What is the potential for changes in water quality, such as, an increase in the concentration of nutrients, suspended sediment and metals, or changes in pH, to adversely affect beneficial uses of surface water in German Gulch? Under Montana's Water Quality Act (MWQA) these beneficial uses are protected. Uses that may be adversely affected are: growth and propagation of salmonid fishes and associated aquatic life (plant and invertebrates): and, aesthetics and recreation qualities. Reduction of flow may also adversely affect water quality and hence beneficial uses.

In cases were numerical criteria are not available, such as nutrients and sediment, impacts to beneficial uses are assessed through monitoring of instream biological (plant and invertebrate) communities. Changes in abundance, community structure and function, reduction of taxa and dominance of the aquatic community by a few taxa, are indices of the degree of impairment of these beneficial uses. When numeric standards have been adopted for particular uses, such as for aquatic organisms or human health, these criteria are used to assess protection of use in addition to the community metrics.

Wildlife

Beal Mountain Mine has been in place since 1988. The initial project affected approximately 450 acres of wildlife habitat. The effects ranged from removal of 25 acres of wildlife habitat to temporary disturbance. The proposed project would expand the mine activity south of where it is presently located and involve an additional 25 acres of disturbance. Adjacent to the project is one of the last relatively undisturbed areas within the Fleecer Landscape. Wildlife concerns specific to the proposed expansion include questions about additional habitat modification, displacement of animals, and cumulative effects with existing mining disturbance. Secondarily, if displacement were to occur, what indirect effect to the Fleecer Landscape wildlife and habitat could be expected?

Fish

How would the proposed action affect fish and their habitat? The indices of measure would be flow rate, turbidity, and concentrations of TSS, nitrates, sulfates, and arsenic.

ISSUES CONSIDERED BUT DISMISSED FROM FURTHER DISCUSSION

Issues which were considered but dismissed from further discussion were: cyanide in ground and surface water, soil resources and vegetation, vegetation and land use, air quality, cultural resources, and seismicity. A complete discussion of these issues considered but dismissed from further discussion are in the EIS.

ALTERNATIVES DISCUSSED IN THE EIS

The South Beal Project proposal (Alternative 1) is to mine 959,840 tons of gold-bearing ore from two small open pits. BMMI would build a 500-600 foot long access road from the haulage road on the south side of the German Gulch drainage to the pits. Ore from the South Beal deposit would be hauled uphill through the existing waste rock dump area to the coarse ore stockpile. It would then be crushed, agglomerated and truck-loaded onto the existing leach pad. A dilute cyanide solution would be used to extract the gold mineral from the ore. This amendment does not change the existing leaching process. The plan would change the permitted tonnage of ore on the heap from 10 million tons to 11 million tons.

In order for BMMI to mine the ore, 1,289,000 tons of waste rock material would have to be removed from the two open pits. The waste rock from South Beal would be removed by blasting,

and dozing. It would then be loaded and hauled to the existing waste rock dump.

Alternative 2 consists of modifications to BMMI's South Beal Project. Modifications include mitigations measures designed to reduce or eliminate adverse environmental impacts and increase the amount of operational and post-operational monitoring.

Alternative 3 is the No Action alternative. BMMI would not develop the South Beal Project. The Beal Mountain Mine would continue as currently permitted.

THE AFFECTED ENVIRONMENT

The proposed South Beal Project is located within National Forest System lands administered by the DNF. The general management plan, for the DNF is found in the Forest Plan, on file at the DNF Supervisor's Office in Butte. The following highlights Forest-wide and Management Area goals and objectives relevant to the South Beal Project.

The Beal Mountain Mine is located within the High Rye Elk Hunting Recreation Opportunity Geographic Area (EHROGA). Twenty-two acres, 87 percent of the proposed action, is within MA E-1, which consists of productive forest land containing stands of Douglas fir, lodgepole pine, subalpine fir and spruce. The lower, northeast edge of the proposed pit and a portion of the haul road, 3.3 acres, 13 percent of the proposed action, are within MA A-6, which consists of nonforest and forested land where timber management and range or wildlife improvements are currently uneconomical or environmentally infeasible.

The host rocks for the South Beal deposit are a calcareous impure quartzite and a dense, chalky white, impure calc-silicate marble. The deposit is in a single bed about 32 feet thick and dipping 15 to 20 degrees northeast, almost paralleling the north-facing hillside slope. Due to the dip slope and extensive fracturing of the rock, some minor creeping occurs on the hillside. The creeping creates some minor changes in the existing topography and somewhat reduces the natural stability of the surface and sub-surface material.

In the highwall of the existing pit is a northwest trending fault, the Gully fault or shear zone which extends below the southwest corner of the leach pad. The width of the shear zone to the northeastern is not known. Another important geologic feature is an unnamed bedding plane which dips to the south. Recently, movement has been noted on the bedding plane. The movement has produced a major slump of a portion of the highwall in the direction of the existing pit.

Extensive exploratory drilling in the area of the proposed South Beal pits shows that the water table is located 25 to 50 feet deeper than the proposed pit floors. Water samples taken from drill holes SBP 1 and SBP 2 indicate that existing ground water quality in this area is good.

German Gulch water quality is generally good and is classified as B-1, suitable for drinking, culinary and food processing purposes, after conventional treatment; and is suitable for bathing, swimming, and recreation, growth and propagation of salmonid fishes and associated aquatic life, waterfowl and furbearers and agricultural and industrial water supply.

Surface water quality in German Gulch has changed since baseline data were collected in 1987 and 1988 for the main Beal mine. The water quality parameters which have changed considerably in the creek monitoring stations are total dissolved solids (TDS), sulfates, and nitrates.

The German Gulch Drainage is part of the Fleecer Mountain complex. The area contains important wildlife resources which are fully discussed in the EIS. Important biological components

of the drainage include regional linkages, edges, riparian areas, lodgepole pine/douglas fir forests and associated species, old growth and associated species, and grasslands.

German Gulch supports a pure strain of westslope cutthroat trout. Westslope cutthroat trout populations were estimated in 1984 at 525 fish 6-10 inches in length per mile of stream near Beefstraight Creek and 230 westslope cutthroat 6-10 inches in length per mile of stream near Edwards Creek. Evaluation of fine sediment (41.6 percent) and cobble embeddedness (34.5 percent), conducted in 1988, indicate spawning and rearing substrate to be in fair condition.

CONSEQUENCES OF THE PROPOSED PROJECT AND ALTERNATIVES

Contaminated Leachate

The rocks associated with the South Beal deposit contain some sulfides, so there is some potential for acid rock drainage. However, it is not expected to occur. BMMI has proposed a rock monitoring program which would allow the company and the agencies to predict problems with acid rock drainage and to prevent drainage of contaminated leachates from becoming a serious problem at Beal. BMMI has committed to address the problem if the heap leach produces acid. BMMI must monitor the interior of the waste dump to help distinguish potential sources for the existing sulfate concentrations. BMMI would also implement additional testing if the agencies determine it is necessary. The agencies would have more data to predict and define the potential for contaminant leaching.

If Alternative 3 is selected, BMMI's commitment to address acid rock drainage from the heap would not be included. If contaminated leachate were to become a problem, the agencies could review BMMI's reclamation plan for main Beal under Section 337 of the Metal Mine Reclamation Act. Also, if contaminated leachate occurs, the marble waste rock from the South Beal waste rock would not be available to cap acid producing rock from main Beal. Any possibility for contaminated leachate from South Beal ore or waste rock would be eliminated if Alternative 3 were selected.

Stability of the South Beal Pits

During development of the deposit, stability of the pit highwall may be a problem. BMMI has committed to mitigation measures which should prevent major failure of the highwall. Impacts from the pit would be short-term because it would be backfilled and reclaimed.

Stability of the Main Beal Heap

The addition of 1 million tons of South Beal ore on the main Beal heap would not affect the stability of the heap.

Ground Water Quality

Impacts to ground water from mining the South Beal pits are expected to be minimal. The South Beal pits would be open two years and would have a short-term effect on ground water. The water table under the proposed South Beal pits is 25 to 50 feet below the estimated levels of the pit floors, and ground water would not come in contact with backfilled waste from main Beal.

There is an unresolved concern regarding sulfate release from main Beal wasterock, which would be used to backfill the pits. Water quality test results from springs discharging below the main Beal waste rock dump indicate that main Beal waste may contribute sulfates to ground water.

However, the sulfate source is uncertain. Potential sources include the use of mulch, dissolution of sulfate minerals, and oxidation of sulfides. If water infiltrates into the backfilled pits, sulfates could be produced and enter ground water. Successful reclamation would minimize any potential for impacts to ground water from release of sulfates. Reclamation and revegetation would reduce infiltration by increasing runoff and evapotranspiration. A change in pH sufficient to mobilize arsenic is extremely unlikely.

Surface Water Quality

The concentration of nitrates and sulfates released from the waste rock pile may continue to increase with the addition of the South Beal waste, but the rate of their increase is not expected to change because the rate of placement on the dump would remain the same.

The potential that nitrates discharged to ground water downgradient of the South Beal pits would reach surface water in German Gulch is minimal due to the distance from the stream and opportunity for uptake by vegetation.

Sulfates are expected to be released from the South Beal ore, but pH of water is expected to remain neutral. If South Beal ore were to start producing acid or harmful effluent, BMMI has committed to a contingency plan, described in Chapter 2, that should effectively address the problems. The heap is part of a zero discharge circuit, and would not release any water to surface water.

The 600 feet of new road may contribute some sediment to German Gulch.

Wildlife

The action alternatives would have short-term effects on wildlife habitat and wildlife.

Fisheries

Increases in concentrations of nitrate and sulfate under Alternative 1 may further affect the aquatic periphyton communities which are already moderately impaired. Over time this may affect fish populations in upper German Gulch. Implementation of mitigations in Alternative 2 would result in smaller concentrations of nitrate and sulfate and less impact to fish populations.

Under Alternative 3, BMMI would continue to direct flows from German Gulch which may adversely affect winter habitat capability upstream of Station 2A. BMP update would result in smaller impacts to water.

CHAPTER I - THE EIS AND PERMITTING PROCESS FOR THE SOUTH BEAL PROJECT

A. Purpose of and Need for Action

1. The Proposed Action

The Department of State Lands and the United States Forest Service have received an application for expansion from the Beal Mountain Mine called the South Beal Project. The agencies' action is to approve, approve with modifications, or to deny the expansion proposal.

The Beal Mountain Mine is a gold and silver mine located in Silver Bow County, Montana, about 16 air miles southwest of Butte in Township 2N, R10W, Sections 5, 6, and 7; and Township 3N R10W, Sections 31, and 32. Beal Mountain Mining Incorporated, (BMMI) a wholly owned subsidiary of Pegasus Gold Corporation of Spokane, Washington, operates the mine under Operating Permit 00135 from the Department of State Lands. The current mine production is about double that originally estimated, and the current workforce is 125 workers, approximately double that originally estimated. Currently BMMI is mining seasonally from March 1 through the end of November. In order to maintain equipment, leaching is carried on year round with the use of buried emitters in the leach pad during winter months. BMMI first submitted the South Beal Project amendment on January 21, 1992. BMMI later withdrew the amendment. On August 18, 1992, BMMI resubmitted the South Beal Project operating permit amendment application in which it proposes to develop a one million ton gold ore body on the south side of German Gulch, within the existing boundary of Operating Permit 00135 (Figure 1). The new disturbance would take place on National Forest System lands.

The proposal is to develop two small open pits that would be backfilled and reclaimed after they are mined out. Mining would be completed during the 1994 mining season, reclamation would be completed the following year. The total number of acres disturbed by BMMI would increase from 424.8 acres to 450 acres, a net increase of 25.2 acres.

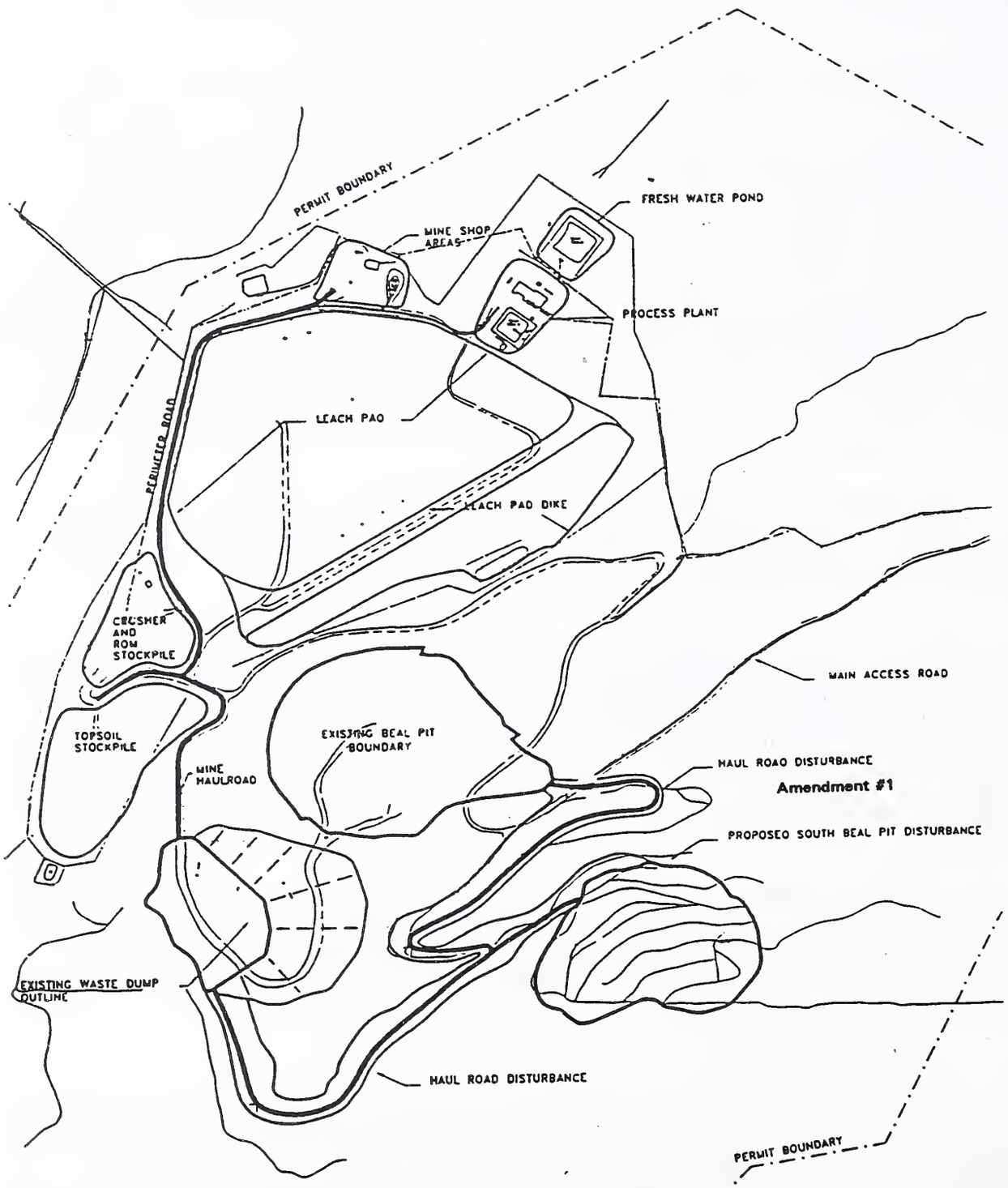
This proposal, which would extend the life of the Beal Mountain Mine by one year, has been proposed as a result of ongoing exploration in the vicinity of the mine. Employment numbers are not expected to change with the development of the South Beal pits. The proposal was determined complete on March 3, 1993. The current reclamation bond total is set at $2,770,000. The bond amount would be adjusted to account for reclamation of the South Beal pits including backfilling, as well as reduced main haul road disturbance, if this proposed amendment is approved. The reclamation bond is projected to increase by $400,000 to $500,000 for the proposed disturbances.

The amendment application is on file and available for review at the Department of State Lands office at 1625 Eleventh Ave., Helena, Montana 59620, and the Deerlodge National Forest office at 1820 Meadowlark, Butte, Montana 59701. This Environmental Impact Statement describes the agencies' analysis of potential environmental consequences of the proposed action and alternatives.

2. Background

BMMI's original plan of operations and permit were approved by the Department of State Lands and the Deerlodge National Forest after review and evaluation of its 1988 application. The agencies prepared and distributed an Environmental Assessment (EA) in July 1988. The Environmental Assessment concluded that the Beal Mountain Mine would have no significant long- or short-term impacts on the German Gulch drainage. In August 1992, BMMI applied for Amendment #1 to the Operating Permit. Amendment #1 moved the haul road from the north side of German Gulch drainage to the south side. An EA was prepared and DSL approved the road on August 14, 1992. The current proposal, if approved, would be the second amendment to the

Figure 1 Project Location Area



original plan of operations and permit. This EIS incorporates by reference the 1988 EA and 1992 EA which are on file and available from the agencies.

B. Agency Roles and Responsibilities

1. Department of State Lands

The Department of State Lands (DSL) administers the Montana Metal Mine Reclamation Act (MMRA). The purpose of the act is to recognize and protect the usefulness, productivity and scenic values of the lands and waters within the state and to reclaim the lands used for mining to comparable stability and utility for beneficial uses. The act and its regulations (ARM 26.4.101 et seq.) set forth the steps to be taken in the issuance of an operating permit for and the reclamation of the applicant's proposed mine expansion. The act applies to all private, federal and state lands within Montana.

The Commissioner of State Lands must decide whether to approve Beal Mountain Mining's application as applied for, approve the application subject to stipulations, or deny the permit, as required by the MMRA Title 82, Chapter 4, Part 3, MCA.

DSL's rules (ARM 26.2.601 et seq.) implementing the Montana Environmental Policy Act (MEPA) (Title 75, Chapter 1, MCA) require preparation of an environmental analysis of the impacts of the project proposal and alternatives. The DSL has determined that an Environmental Impact Statement (EIS) is appropriate for this project. The purpose of this EIS is to:

a. Ensure that the agency uses the natural and social sciences and the environmental design arts in planning and decision-making;

b. Assist in the evaluation of reasonable alternatives and the development of conditions, stipulations or modifications to be made a part of a proposed action;

c. Examine and document the effects of a proposed action on the quality of the human environment, and provide the basis for public review and comment.

2. United States Forest Service

The United States mining laws (30 U.S.C. 21-54) confer a statutory right to enter upon the public lands to search for minerals. USFS regulations (36 CFR 228, subpart A), among others, require that mineral operations be conducted so as to minimize adverse environmental impacts on National Forest System surface resources. USFS policy is to encourage and facilitate the orderly exploration, development and production of mineral resources from National Forest System lands. At the same time, the USFS must ensure that these activities are conducted in an environmentally sound manner, and that once completed, the land is reclaimed to a stable and usable condition.

This EIS was developed in compliance with the implementing regulations of the National Environmental Policy Act (NEPA) Council on Environmental Quality, Title 40, Code of Federal Regulations, part 1500-1508 (40 CFR 1500-1508) and the National Forest Management Act (NFMA), Title 36, Code of Federal Regulations, Part 219 (36 CFR 219). Various discussions and consequences within this document are tiered to the 1987 Deerlodge National Forest Plan and EIS. These documents are incorporated by reference at the appropriate passages throughout this document. While the Forest Plan and EIS discussed issues such as the determination of suitable timber lands, the availability of various recreation opportunities, actions necessary to provide wildlife habitat and the management direction for inventoried roadless lands, this document will focus on those specific environmental issues relative to the proposed action.

3. Other State Agencies

a. State Historic Preservation Office

The State Historic Preservation Office (SHPO) is responsible for cooperating with and advising DSL and the USFS when potentially valuable historical, archaeological, or other cultural resources are located within a project area (Montana Antiquities Act Sections 22-3-401 through 22-3-442, MCA, and the National Historical Preservation Act [P.L. 89-665 as amended and reauthorized E.O. 11593]). Advice given to the agencies may include comments on an applicant's plan for impact mitigation of sites eligible for nomination to the National Register of Historic Places. The office also reviews the EA or EIS to ensure compliance with cultural resource regulations.

During mine operation, the agencies are responsible for monitoring compliance with historic preservation and monitoring plans.

b. Department of Health and Environmental Sciences

(1) Air Quality Bureau

The Air Quality Bureau of the Department of Health and Environmental Sciences (DHES) administers the Clean Air Act of Montana (Title 75, Chapter 2, MCA). Any proposed project with potential to emit more than 25 tons per year of any pollutant must obtain an air quality permit prior to construction. The applicant must apply Best Available Control Technology to each emission source. The applicant must also demonstrate that the project would not violate Montana or Federal Ambient Air Quality Standards. The Air Quality Bureau already modified BMMI's air quality permit (#2472-02) to include the South Beal Project on February 18, 1992. Additional information about the air quality permit is on file at the Air Quality Bureau, Cogswell Building, Capitol Station, Helena, MT.

(2) Water Quality Bureau

The Water Quality Bureau of DHES is responsible for administration of the Montana Water Quality Act (Title 75, Chapter 5, MCA), providing for the classification of surface waters, establishing surface water quality standards, and administering permit programs to control the discharge of pollutants into state waters.

4. Hard Rock Mining Impact Board

The Hard Rock Mining Impact Board created by the passage of the Hard Rock Impact Act (Title 89, Chapter 6, Part 3, MCA) is attached to the Montana Department of Commerce. A quasi-judicial board, it is intended to act as a "referee" in hearing disputes between local government units and large-scale mineral developers over the impact mitigation plan prepared by the developer. In the impact mitigation plan, the developer identifies the increased public sector costs associated with major mineral development and commits to pay, according to a specified time schedule, all increased capital and net operating cost to local government units resulting from development. The Hard Rock Mining Impact Board gave BMMI a waiver to the impact plan requirement on Oct. 23, 1990 (Carol Ferguson, personal communication).

C. Public Participation

Public participation is an important part of an EIS. The National Environmental Policy Act (NEPA) and the Montana Environmental Policy Act (MEPA) are Federal and State laws which direct the USFS and the DSL to disclose the effects of proposed activities on Federal and State lands to the public and to officials making decisions concerning the proposal.

When the South Beal Project was originally submitted in January 1992, the DSL and USFS

sought public and other agency input to help identify environmental issues and concerns with BMMI's proposal through the process called scoping. Scoping activities for this project included holding a public meeting in Butte, Montana, on February 6, 1992, letters to citizens and groups interested in activities in the project area, and soliciting written comments through a press release in the newspaper (Mt. Standard, January 24, 1992). A legal notice ran in the newspaper for three consecutive weeks. The public comment period was held open until February 21, 1992. In addition to the public meeting and letters, BMMI conducted meetings with local groups to discuss the proposal. A list of all issues and concerns raised in scoping and through the agency review process is presented in the next section of this EIS.

D. Issues and Concerns Raised in Scoping

Comments received during the public meeting and in writing were compiled and reviewed. Interdisciplinary team specialists from the DSL and USFS also raised comments and concerns during the usual review of the application and scoping. All issues are summarized below:

1. Geology and Engineering

What is the potential for the mine material to produce contaminated leachates? The index of measure will be pH and static and kinetic test results.

Would the South Beal pits be stable? If they fail, would the area to be reclaimed be larger? The indices of measure will be visual observation of pit walls and edges for movement.

Because of operational stability problems in the main Beal pit, would the addition of ore on the heap affect the stability of the heap and/or pit? The indices of measure would be movement recorded by survey of monuments and visual observations of highwall and leach pad areas.

2. Ground and Surface Water

Would the proposed action affect water quantity? The index of measure will be flow rate. Would the proposed action affect ground and surface water quality in the German Gulch drainage? Specifically, how would the proposed action affect sediments and concentrations of total suspended solids (TSS), total dissolved solids (TDS), nitrate, sulfate, arsenic and other metals? Indices of measure will be concentrations of the parameters listed above.

What is the potential for changes in water quality, such as, an increase in the concentration of nutrients, suspended sediment and metals, or changes in pH, to adversely affect beneficial uses of surface water in German Gulch? Under Montana's Water Quality Act (MWQA) these beneficial uses are protected. Uses that may be adversely affected are: growth and propagation of salmonid fishes and associated aquatic life (plant and invertebrates), aesthetics and recreation qualities. Reduction of flow may also adversely affect water quality and hence beneficial uses.

In cases were numerical criteria are not available, such as nutrients and sediment, impacts to beneficial uses are assessed through monitoring of instream biological (plant and invertebrate) communities. Changes in abundance, community structure and function, reduction of taxa and dominance of the aquatic community by a few taxa, are indices of the degree of impairment of these beneficial uses. When numeric standards have been adopted for particular uses, such as for aquatic organisms or human health, these criteria are used to assess protection of use in addition to the community metrics.

3. Wildlife

Beal Mountain Mine has been in place since 1988. The initial project affected approximately 450 acres of wildlife habitat. The effects ranged from removal of 25 acres of

wildlife habitat to temporary disturbance. The proposed project would expand the mine activity south of where it is presently located and involve an additional 25 acres of disturbance. Adjacent to the project is one of the last relatively undisturbed areas within the Fleecer Landscape. Wildlife concerns specific to the proposed expansion include questions about additional habitat modification, displacement of animals, and cumulative effects with existing mining disturbance. Secondarily, if displacement were to occur, what indirect effect to the Fleecer Landscape wildlife and habitat could be expected?

4. Fish

How would the proposed action affect fish habitat? The indices of measure will be flow rate, turbidity, and concentrations of TSS, nitrates, sulfates, arsenic and copper.

E. Issues Considered but Dismissed from Further Discussion

1. Cyanide in Ground and Surface Water

Low concentrations of cyanide have been detected in several springs and monitoring wells in the area. Concentrations reached up to .281 mg/L in the blanket collector drain (BCD) under the heap leach in May, 1991 (Figure 3). Concentrations were lower in the springs and wells. Currently there is no maximum contaminant level for cyanide. However, the Environmental Protection Agency (EPA) Office of Drinking Water has issued a health advisory level of 0.2 mg/L cyanide as a regulatory standard. Montana water quality criteria for acute and chronic levels of cyanide are .022 mg/L and .0052 mg/L respectively. BMMI also had a leak in its barren pond liner in 1990 which was fixed in 1991. The concentration of cyanide in the BCD was .015 mg/L in May, 1992. These concentrations were probably due to cyanide from the liner leak still flushing from the system. The most recent samples did not contain any detectable cyanide. BMMI has adequately addressed the issue of cyanide in ground and surface waters and cyanide is no longer an issue.

2. Soil pH Effects on Revegetation

One of the questions raised in the review of the amendment was "Would the low pH of the soils salvaged at South Beal limit revegetation attempts as it has done on revegetation attempts in the main Beal area? " In some areas of BMMI's current operation, limited success has been observed in attempts to revegetate reclaimed land surfaces.

In 1991, BMMI, in consultation with the regulatory agencies and the USDA Soil Conservation Service and representatives from Montana State University's Reclamation Research Unit, reviewed the existing revegetated acres on the mine site. Soil pH problems and possible soil amendments were discussed and seed mix modifications were suggested.

In the 1988 application, BMMI committed to soil testing to identify fertilizer recommendations. If revegetated plant communities develop plant nutrient deficiency symptoms, BMMI would take appropriate measures to correct the problem. In the proposed South Beal Project, BMMI has committed to soil sampling before soil redistribution to identify pH problems and elevated concentrations of aluminum and manganese. Based on the results of the testing, a soil amendment program would be initiated. BMMI has also proposed monitoring of revegetation success of South Beal disturbances.

Based on the proposed testing and monitoring, the agencies have concluded that there would be no cumulative impacts to the soil resources and revegetation plan as a result of the South Beal amendment.

3. Land Use

The project would disturb over 25 acres of forested ground in German Gulch. The

interdisciplinary team from the agencies reviewed the potential impacts to vegetation and concluded that destruction of that 25 plus acres of forest land would not create large impacts to wildlife use of the area. BMMI has not proposed any changes in the previously approved post-mining land use goals. Therefore, the review team concluded the South Beal Project would not cause any cumulative land use impacts.

4. Cultural Resources

The South Beal Project would have no lasting visual or intrusive effect on the integrity of the historical district. Disturbances would be reclaimed. After consideration of the extent of prior cultural resource inventories, GCM Inc.'s mitigation excavation and research, and the fact that there would be no adverse effects to the National Register of Historic Places eligibility of the historical district, the project does not require any further cultural resources work and/or mitigation. The SHPO has agreed that the South Beal Project would have no adverse effect on the German Gulch Historic Mining District (Katherine M. Huppe, SHPO, letter to Richard Periman, dated April 28, 1992). A letter was sent to the Advisory Council on February 9, 1993. The agencies are waiting for a response prior to publication of the Final Environmental Impact Statement (FEIS).

5. Seismicity

The project is located in a very low seismic area. No earthquakes have been recorded in the last 100 years that would affect the project area. Therefore, slope failure due to earthquake is not an issue.

CHAPTER II - SUMMARY OF PROPOSED ACTION, ALTERNATIVES, and REASONABLY FORESEEABLE ACTIVITIES

This chapter summarizes the proposed action: the South Beal Project, the South Beal Project with modifications, and the No Action alternative. The first section describes the project proposal, followed by a description of the No Action alternative. Alternatives dismissed from detailed analysis in this EIS are described in the next portion of this chapter. This is followed by, Reasonably Foreseeable Activities, which discusses the reasonably foreseeable future activities by Federal or State agencies within the project area which are included in the cumulative impact assessment. The discussion in Chapter 5 compares all alternatives.

A. Alternatives

1. Alternative 1 The South Beal Project

a. Mining Plan and Methods

The South Beal Project is designed to mine 959,840 tons of gold-bearing ore as two small open pits. BMMI would access the South Beal pits by the new main haulage road on the south side of the drainage. BMMI would build a 500-600 foot long access road from the haulage road to the pits. Ore from the South Beal deposit would be hauled uphill through the existing waste rock dump area to the coarse ore stockpile. It would then be crushed, agglomerated and truck-loaded onto the existing leach pad. The final phase of the existing leach pad that was completed in 1992 is of sufficient size to hold the South Beal ore. A cyanide solution would be used to extract the gold mineral from the ore. This amendment does not change the existing leaching process. The plan would change the permitted tonnage of ore on the heap from 10 million tons to 11 million tons.

In order for BMMI to mine the ore, 1,289,000 tons of waste rock material would have to be removed from the two open pits. The waste rock from South Beal would be removed by blasting, and dozing. In the initial phases of mining the South Beal deposit, waste rock would be loaded and hauled to the existing waste rock dump. Waste rock tonnage would increase from a permitted 6.4 million tons to 7.7 million tons. Later, waste from the main Beal pit would be used to partially backfill the South Beal pits. Remaining waste needed to completely backfill both pits would come from the main Beal pit.

To reduce the potential for pit wall saturation, BMMI would implement several safety measures. BMMI commits to 1) remove snow before spring thaw, 2) drill horizontal dewatering wells into the final pit slope before the winter of 1993-1994, and 3) construct a diversion ditch around the upgradient perimeter of the pit, if necessary. If either groundwater seepage or storm water were to become a problem in the pits during operations, an in-pit sump would be constructed and pumped. Water from this sump would be disposed of by sprinkling either on the waste rock dump or used for irrigation water during reclamation.

In its original application, BMMI committed to mitigation measures to reduce impacts on air quality, hydrology, fish and wildlife and vegetation, including sediment and erosion control systems. These mitigation plans have been slightly modified to include South Beal.

b. Timber Removal

The South Beal pits would be cleared of timber (25.2 acres). All merchantable timber, including sawlogs and timber suitable for posts and poles, would be sold as commercial wood products. Slash and other timber residue would be stacked and burned in compliance with the existing Burn Permit. Easily accessible firewood would be removed by Beal employees.

c. Soil Salvage

After timber removal, soil would be salvaged from all areas to be disturbed except for slopes exceeding 50 percent. The soil would be stripped to an average depth of 26 inches. Because of the generally steep slopes, soil would be salvaged by a dozer pushing soils into piles on flatter areas or pushing to constructed pick-up areas. Soil would then be loaded and hauled to the main soil stockpile and interim seeded or directly applied to recontoured areas, such as lower portions of the waste rock dump. BMMI would test soil and add amendments such as lime, based on the testing. Approximately 78,000 cubic yards of soil would be stockpiled from the pit area.

d. Mining Schedule

The South Beal ore deposit is located on the northern exposure of German Gulch. It is in a heavily timbered area, most of which is covered by small diameter closely spaced trees. Because of a late spring season, conditions suitable for mining are from mid-June through November.

Timber removal, soil salvage, and storage activities would be conducted during June 1993. Mining would begin in the south Beal pits upon completion of these activities. The mining would be completed and backfilling and reclamation would begin in 1994. Backfilling both pits with waste rock from the main Beal pit would bring the mined-out areas back to near original contour. Reclamation would be completed in 1995.

e. Geochemical Characterization

Backfill would be tested to ensure surface material is not acid producing and would not cause acidification of cover soil. A geochemical verification program, involving pH and static testing to evaluate the potential for acid production, would collect one representative grab sample per 50,000 tons of material from different lithologic classes of waste. If a review of the static test results for ore or waste samples suggest that the risk of acid production has increased due to a change in the geochemical character of material being mined, then a representative number and kind of samples will be tested in humidity cells using kinetic testing protocol.

f. Operational Monitoring

BMMI would continue with the water resources monitoring plan currently used at BMMI, with the addition of nitrate to the indicator parameter list. The water resources monitoring plan incorporates 5 springs, 22 wells, and 11 stream monitoring stations. All stations would be sampled ten times annually for indicator parameters or three times a year for extended analysis. One site would be monitored daily. Indicator analysis would occur every month that extended analysis is not done. Three monitoring wells were added for the South Beal Project. One is upgradient of the proposed pits, and two are downgradient, between the proposed pits and German Gulch. These wells have been monitored since the summer of 1992 (See Figure 3).

g. Reclamation Plan

Pits: After mining, the southwest pit would be partially backfilled with waste rock from the larger southeast pit. The southeast pit would not be completely backfilled at that time to allow haul road access through the pit. Once the southeast pit is mined out, both pits would be backfilled in 25-foot lifts with waste rock from the main pit. Backfill would be contoured to blend with adjacent undisturbed ground and would tie the minor swales together to reestablish original surface drainage patterns. Post-reclamation land use of the South Beal area would be primarily wildlife habitat with site conditions suitable for development of a forest resource.

Heap: BMMI's reclamation techniques, methods, and commitments from the original 1988 Beal reclamation plan would remain essentially unchanged. After the heap cyanide is neutralized,

the liner will be perforated, the entire pad area covered with 20 or more inches of soil, and revegetated. The height of the pad, final configuration, and drainage patterns have changed slightly with the addition of ore. If the leach pad produces acid, BMMI has committed to address the problem. Possible mitigation measures may include the addition of a cap of non acid-forming or alkaline material, liming, addition of phosphate rock to reduce the rate of acid formation, reduction in the amount of seepage through the spent ore, or collection and treatment of seepage out of the spent ore pile.

Approximately 100,000 tons of high neutralizing potential marble waste rock would be removed from the South Beal pits and stockpiled for capping of any areas with acid producing potential at the end of mine reclamation.

Backfill would be tested to ensure that it is not acid producing and would not cause additional acidification of cover soil. The estimated volume of backfill to achieve designed post operation topography is 1,031,600 loose cubic yards (lcy).

In-pit roads would be eliminated through backfilling. The proposed 500-600 foot long haul road connecting the existing haul road to the South Beal pits would be removed after pit backfilling, soil distribution, testing, and revegetation (See Figure 1).

h. Reclamation Monitoring

BMMI would monitor revegetation, soils, and water resources to determine success and evaluate modifications to the reclamation plan if necessary. BMMI's conceptual plan is to monitor 8 wells, 2 springs, and 3 surface water stations twice a year. Waste rock used for haul road construction and for surface materials (below respread soils) in the backfilled pits would be sampled for acid-base balance to ensure that acid drainage or acidification of coversoil does not occur. BMMI would monitor surface water control structures.

2. Alternative 2 The South Beal Project with Modifications

Modifications proposed by the agencies to BMMI's proposal include mitigating measures designed to reduce or eliminate environmental impacts not adequately addressed by BMMI and to increase company coordination with the agencies. The following modifications would be incorporated by the agencies as stipulations to the permit if this alternative were selected by the decision-makers. All other aspects of BMMI's South Beal Project would remain the same.

Ground and Surface Water

1) BMMI would not dispose of water from the South Beal pit sump onto the waste rock dump or use it for irrigation water. This water would be either returned to the processing circuit or treated by land application disposal or other appropriate methods. BMMI would sample pit sump water monthly for extended analysis parameters.

2) BMMI would submit water quality monitoring reports from the South Beal upgradient and downgradient monitoring wells and surface water stations 3, 3a, and 4, and Spring 5, to the DSL and USFS monthly during the mining of South Beal. (See Figure 3). The reports would be submitted in hard copy and in electronic format compatible with the STORET database, in order to facilitate independent analysis of the data. All monitoring reports would be submitted quarterly, in the same format used for South Beal monitoring. BMMI would monitor the two downgradient South Beal wells until water quality standards are assured in the long-term.

3) BMMI would consult with the agencies to field review Best Management Practices (BMPs) prior to ground disturbance. BMMI has applied for a storm water permit, which will include the development of site specific BMPs and a storm water pollution prevention plan. BMMI would be required to implement all BMPs in the storm water permit. In addition to the BMPs in the stormwater permit, BMMI would implement the following BMPs for preservation of water quality:

a. BMMI would adjust fertilizer and mulch application practices to minimize nitrate and sulfate concentrations in runoff from reclaimed areas.

b. BMMI would handle ANFO to minimize nitrate release by having a redundant blast initiation system, by monitoring blasts to ensure minimal amounts of explosives are used, and by preventing, reporting and cleaning up ANFO spillage.

c. BMMI would submit details of South Beal surface water drainage plans to the agencies for approval prior to final reclamation.

d. BMMI would implement sediment control structures prior to ground disturbance.

4) BMMI would not perforate the liner under the heap before reclamation begins. BMMI would breach the heap dikes to the low points in the collection sumps to prevent water build-up or would propose another plan that is equally effective in reducing phreatic water build-up. Under the proposed post-operational monitoring plan BMMI would be required to monitor water quality until it is assured that appropriate Montana Water Quality Standards, in particular nondegradation, can be met in the long-term. The standards which must be met include, but are not limited to, maximum contaminant levels (MCLs) for nitrates, sulfates, arsenic and pH. At that time, BMMI would submit the detailed plan for liner perforation or long-term water collection and treatment.

5) BMMI would implement an aquatic biological monitoring program to assess the degree of impairment at sites potentially affected by the mine. Since aquatic communities are dynamic in nature and are affected by environmental factors not related to mine activities, the site would be evaluated relative to instream control site or reference streams. Suitability of reference stream would be evaluated on the following habitat criteria:

1. flow
2. gradient
3. elevation
4. substrate composition
5. aspect
6. vegetative cover (canopy)
7. major ion chemistry

Site 4 on upper German Gulch was originally selected for a water quality control site, however, due to elevated nitrate in ground water in the vicinity and sediment from various sources, this site cannot be used as a control site. Other possible locations for a reference site include Edward Gulch, Greenland Gulch, Beefstraight Creek, or Norton Creek.

During the first year of collection, periphyton and aquatic macroinvertebrate samples would be collected in the spring (April), summer (July-August) and fall (September-October). Standard procedures for field and laboratory methods would be employed for macroinvertebrates (EPA, 1990), periphyton community

composition (Bahls, 1993) and biomass (USGS, 1987) collection and analysis. In addition to standard statistical analyses, data will be evaluated based on standard community metrics, such as, species richness, species composition, EPT: Chironomide, Hilsenhoff, and other measures of biological integrity (EPA, 1989). When appropriate, results would be compared to pre-mining conditions.

After the first complete year of biological sampling, BMMI and the agencies would determine the suitability of reference sites, sampling protocols and analytical procedures. Timing and the level of analysis may be adjusted to knowledge gained during the first year of analysis. Operation biological monitoring would continue for the life-of-mine.

6) BMMI would stockpile South Beal neutral waste and use it for capping the waste rock dump and possibly the heap leach pad if infiltration and seepage become a problem. BMMI would test its proposed main Beal test capping sequence to evaluate the effectiveness of capping layers to limit infiltration. BMMI would monitor the interior of the waste dump to help distinguish potential sources for the existing sulfate concentrations. BMMI would implement kinetic testing or field test plots as determined appropriate by the agencies.

7) BMMI would add lime to the waste rock or cap the waste rock dump to prevent infiltration to the dump, if water quality changes measurably and water parameters of concern increase.

8) BMMI would consult with the agencies including Montana Department of Fish, Wildlife and Parks (MDFWP) Fisheries Biologist, prior to further diversions of water from Springs 5 and 3.

Engineering

9) BMMI would use the specifications described in the main Beal application for diversion structures around the heap. BMMI would engineer outlet structures for the release of the diversion water. BMMI would line the surface water diversion ditches to minimize seepage in the area of the Gully fault during final reclamation.

10) BMMI would continue to pump dewatering wells in the main Beal pit until stability of the heap is no longer an issue and a failure of the heap would not adversely affect water quality.

3. Alternative 3 The No Action Alternative

The Beal Mountain Mine would remain in operation as currently permitted. The currently permitted operating plan is on file with the agencies. The environmental effects of BMMI's current operating plan and road were previously analyzed in an EA dated July 1988 and in an EA dated August 14, 1992.

B. Reasonably Foreseeable Activities

Within the general project area there are other activities occurring currently or which may occur in the future which could potentially result in cumulative environmental impacts.

Current exploration drilling indicates that the ore zone at the main Beal pit is larger than originally expected. As future exploration drilling further defines the ore zone, BMMI plans to amend its operating permit to deepen the main Beal pit. At this time, BMMI has not filed an amendment to deepen the main Beal pit, but has discussed study plans for a possible future

amendment with agency staff. In a meeting with the agencies on January 7, 1993, BMMI indicated that this amendment may be submitted to the agencies as soon as Summer, 1993. In addition, BMMI continues to explore in the vicinity, and has identified targets with future development potential. All disturbances from the South Beal amendment have been condemnation drilled and are outside of the areas where future disturbance or expansion would occur.

The Forest Service currently administers grazing allotments in the area of the Beal Mountain Mine. Grazing permits on these allotments would continue as currently allotted by the USFS.

CHAPTER III EXISTING ENVIRONMENT

This chapter describes the existing environment. Additional detail may be found for some resources in the 1988 EA.

The proposed South Beal Project is located entirely within National Forest System lands administered by the DNF. The general management direction for the DNF is found in the 1987 Forest Plan, on file at the DNF Supervisor's Office in Butte. This document provides Forest-wide goals and objectives (p.II-1-5), and goals and standards for sub-units of the Forest referred to as Management Areas. The following highlights those Forest-wide goals and objectives, management area goals and standards relevant to the proposed action addressed in this EIS.

A goal of the Deerlodge Forest Plan is to facilitate development of mineral resources (p. II-1). The objective for minerals is that lands will be managed to maintain reasonable levels of availability and accessibility. The effects of surface, renewable resource activities and allocations on minerals exploration and development will be considered for each plan of operation or lease submitted (p. II-4).

Applicable Forest-wide standards for minerals include: (1) Develop realistic operating plans and operating conditions on all mineral activities. (2) Promote access to and orderly development of needed mineral commodities. Interdisciplinary review of plan proposals will consider area management objectives and area transportation plans (p. II-31).

Appendix N of the Deerlodge Forest Plan contains Hunting Recreation Opportunity Objectives for specific geographic areas. The Beal Mountain Mine is located within the High Rye Elk Hunting Recreation Opportunity Geographic Area (EHROGA). This 28,000 acre area is roaded and lightly developed. The maximum open road density is 0.5 mi/ sq. mi., the minimum hiding cover is 36 percent and the elk effective cover is to be maintained at or above 70 percent. The Hunting Recreation Opportunity Objective for this area is to provide for walk-in hunting opportunities. Motorized access will be permitted on a few roads within the area. Game retrieval distance will vary from 0-3 miles. The challenge and risk will vary from low to moderate. (p. N-7).

Chapter III of the Deerlodge Forest Plan describes Management Areas (MA) including goals, land management direction to achieve the Forest-wide goals, objectives and standards found in Chapter II of the Plan. The proposed action is located in Management Areas E-1 and A-6.

The majority of the proposed action, 87 percent, on 21.9 acres is within MA E-1, which consists of productive forest land containing stands of Douglas fir, lodgepole pine, subalpine fir and spruce. Most areas are on slopes less than 40 percent. MA E-1 may contain inclusions of nonforest lands and lands of low productivity. The goal in this area is to provide healthy stands of timber and economic levels of timber while maintaining overall levels of wildlife habitat, livestock grazing and dispersed recreation. The standards for locatable mineral development include: (1) Mineral-related operations will be according to approved operating plans. Conditions and stipulations will maintain timber production to the extent practical. (2) Access requests will be evaluated and allowed on a case-by-case basis. Part of the evaluation will consider needs and will be dependent on whether or not it can be demonstrated that such access is the next logical step beyond the existing exploration and/or developmental stage. Such access will be coordinated with and incorporated into the area transportation plan. Final reclamation of all roads not needed for future management will be to near natural conditions (p. III-54, 55).

Figure 2 Deerlodge Forest Plan Management Area Map

The lower, northeast edge of the proposed pit, 13 percent of the project, is on 3.3 acres within MA A-6, which consists of nonforest and forested land where timber management and range or wildlife improvements are currently uneconomical or environmentally infeasible. Often included are areas which are steep and rocky, have poor accessibility, or are low in productivity. The goals in this area are to preserve the areas' present condition with minimal investment for resource activities consistent with protection of basic soil, water, and wildlife resources; and to permit activities necessary to meet the management direction of adjacent management areas. Standards for locatable mineral development include: (1) Encourage use of low impact (geochem, geophysical) prospecting methods. (2) Access requests requiring dirt moving will be evaluated and allowed on a case-by-case basis. Part of the evaluation will consider needs and will be dependent on whether or not it can be demonstrated that such access is the next logical step beyond the existing exploration and/or development stage. Such access will be coordinated with and incorporated into the area transportation plan. (3) Final reclamation will include closing and restoring roads not needed for access to adjacent management areas to near natural conditions (p. III-14, 15).

A. Geology and Engineering

1. Geology

a. Geologic Features

The geology of the main Beal deposit was described in detail in the 1988 EA. The host rocks for the South Beal deposit are a calcareous impure quartzite and a dense, chalky white, impure calc-silicate marble. The deposit is in a single bed about 32 feet thick and dipping 15 to 20 degrees northeast, almost paralleling the north-facing hillside slope. The South Beal host and country rocks have been metamorphosed. The metamorphic assemblage of biotite, diopside, potassium feldspar, chlorite, scapolite, quartz, actinolite-tremolite and hornblende is similar to the assemblage at the main Beal deposit.

Igneous rocks within and peripheral to the deposit include diorite and granodiorite. A diorite stock is located 200 to 300 feet southwest of the deposit. This rock is the same as the stock located on the western side of the main Beal deposit. Coarse-grained, equigranular granodiorite is located 3000 feet east of the deposit. This is the same granodiorite located 2500 feet east of the Beal deposit, and is considered to be part of the Boulder Batholith.

Major geologic structures in the mine area include the German Gulch fault, the Beal shear, the Gully fault located in the highwall of the main Beal pit, an unnamed bedding plane on which significant movement has recently occurred, and northwest trending normal faults. The South Beal deposit is extensively fractured in a predominantly east-west direction with secondary north-south patterns. This is consistent with the fractures at the main Beal deposit. For the South Beal deposit only minor east-west shearing was field mapped but extensive fracturing has occurred. A northwest trending normal fault is located on the east side of the deposit. Displacement is unknown, but the fault does not appear to displace gold mineralization.

2. Engineering

a. Structural Geology and Associated Geologic Hazards

(1) South Beal

The South Beal deposit is located on the north-facing slope of German Gulch, east of Mt. Haggin, in the eastern portion of the Pintlar Range. The slope of the hillside ranges from 25 to 60 percent. Stratigraphic units in this area dip in the same direction as the surface slope. Some minor creeping occurs on the hillside. This creates some minor changes in the existing topography and

somewhat reduces the natural stability of the surface and sub-surface material. The marble is only slightly fractured and has good strength. The quartzite hornfels rock is highly fractured, 95 percent of the rock is broken into small pieces and is held together with soft clay. The extensive fracturing and weathering of the rock in the South Beal area make the slope potentially unstable.

(2) Main Beal

The main Beal deposit is located on the south facing slope of German Gulch. In the highwall of the existing pit is a northwest trending fault, the Gully fault or shear zone, which extends below the southwest corner of the leach pad. The northeastern extent of the shear zone is not known. Another important geologic feature is an unnamed bedding plane which dips to the south. Recently, movement has been noted which has produced a major slump of a portion of the highwall in the direction of the existing pit.

The slump block seems to be bound on the east by the Gully fault. It is not clear whether movement will occur further east in an area occupied by the existing heap leach pad. BMMI has buttressed the slump block and is currently dewatering the highwall with horizontal drains. BMMI has reconfigured the heap leach pad to avoid a known part of the Gully fault shear zone.

The existing heap leach pad currently has 7.1 million tons of gold bearing ore heaped on it (personal communication with Tad Dale of BMMI on 2/19/93). The heap top is relatively flat and the side ore benched with the slope between the 15 foot high, 8 foot wide benches at 1.5:1. The overall slopes of the sides vary from 2:1 to 2.5:1. BMMI is using a dilute cyanide solution to extract the gold from the heaped ore.

B. Hydrology

1. Ground Water

Extensive exploratory drilling in the proposed South Beal pit area shows that the water table is located 25 to 50 feet deeper than the proposed pit floors. Water samples taken from drill holes SBP 1 and SBP 2 indicate that existing ground water quality in this area is good. The ground water is classified as Class I, suitable for public and private water supplies, culinary and food processing purposes, irrigation, livestock and wildlife watering, and for commercial and industrial purposes with little or no treatment. Aluminum, iron, manganese, zinc, lead, arsenic, chromium and copper were detected in water samples from these drill holes, but concentrations did not exceed maximum contaminant levels (MCLs). MCLs are standards designed to protect present and future beneficial uses of ground water. Aluminum, zinc, and copper not have ground water standards.

2. Surface Water

No springs or streams are known to exist on the south side of German Gulch which would be impacted by the proposed South Beal pits. The only surface water which potentially could be impacted by this amendment would be German Gulch. German Gulch water quality is generally good and is classified as B-1, suitable for drinking, culinary and food processing purposes, after conventional treatment; and is suitable for bathing, swimming, and recreation, growth and propagation of salmonid fishes and associated aquatic life, waterfowl and furbearers and agricultural and industrial water supply.

Surface water quality in German Gulch has changed since baseline data were collected in 1987 and 1988 for the main Beal mine. The only water quality parameters which have changed considerably in the creek monitoring stations are total dissolved solids (TDS), sulfates, and nitrates. Concentrations of TDS in German Gulch from directly below the operation to Station 2A (approximately one mile downstream) have doubled since baseline data were collected. TDS at Station 2A has risen from an average of 136 ppm at the beginning of operations in 1988 to 227

ppm in 1991. Increases in TDS are more pronounced below the pit than above. This increase is related to activities in the main Beal pit and the waste rock pile. Montana's water quality standard for TDS in drinking water is 500 mg/L.

Sulfate concentrations in Spring 5, which flows from underneath the waste rock dump, have increased from a baseline level of approximately 12 mg/L in 1988 to 152 mg/L in December of 1991. This increase in sulfate may be the result of oxidation of sulfide minerals in the main Beal waste rock pile. Other potential sources are dissolution of sulfate minerals and hydromulching. BMMI is diverting flow from Spring 5 to a catchment pond for use in the processing circuit.

BMMI is already using Best Management Practices for control of water quality related to the main pit. If necessary, mitigations designed to further protect water quality in German Gulch below the main Beal pit will be modified pursuant to Section 337 of the Montana Metal Mine Reclamation Act to lessen impact to water quality.

3. Water Quality

a. Nitrate Concentrations in Ground and Surface Water

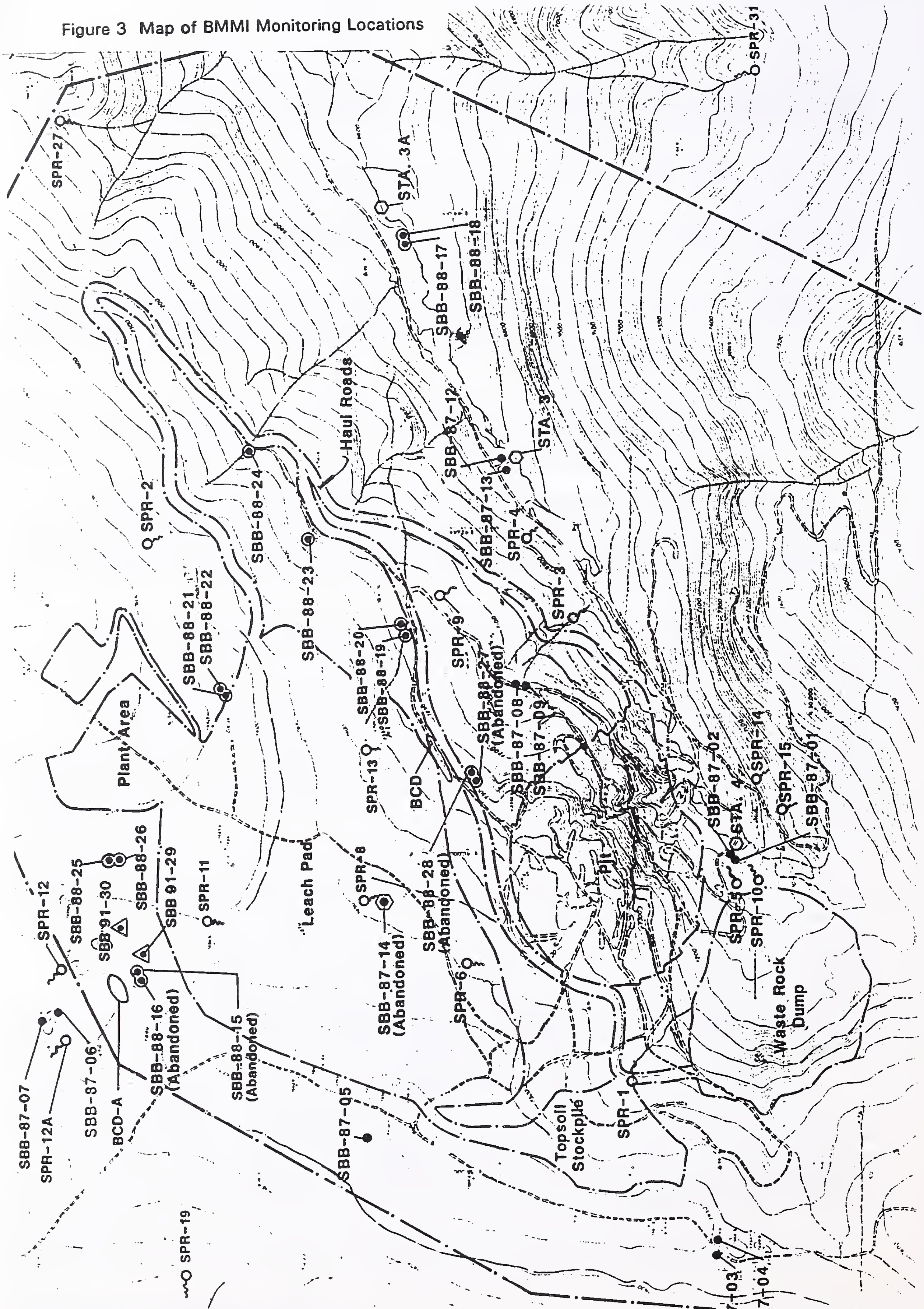
Nitrate concentrations have increased in surface and ground water in the vicinity of the main Beal project relative to background baseline conditions. Nitrate concentrations have increased downgradient of the waste rock dump, downgradient from the leach pad on the north side, downgradient from the leach pad on the south side, and in German Gulch Creek. The Montana Water Quality standard for nitrate in ground water is 10 mg/L.

Below the waste rock dump nitrate concentrations have increased from below detection limits to up to 19.7 mg/L in Spring 5. A single sample from monitoring Well SBB 87-01 contained 30 mg/L NDs (see Figure 3 map of monitoring sites). Nitrate levels in Spring 5 increased from below detection limit in 1987, 1988 and early 1989 to approximately 1 mg/L in the summer and fall of 1989. Nitrate concentrations remained around 1 mg/L throughout 1990 although an increase to 3.9 mg/L did occur in November. Nitrate concentrations peaked at 12.5 mg/L in April of 1991, but remained high at 7.6 mg/L in July of 1991 and 7.7 mg/L in November of 1991. In 1992, nitrate concentration in Spring 5 rose further, reaching nearly 20 mg/L before BMMI decided to capture the spring water. Possible sources of nitrate include ANFO, fertilizer and slash and burn sites.

Downgradient of the heap leach on the north side, nitrate concentrations have increased from below 1 mg/L in Spring 12A to 42.3 mg/L. Well SBB 87-07 nitrate concentrations increased from below detection limit to 38.5 mg/L in the spring of 1991. The last two measurements of nitrate concentrations in Well SBB 87-07 were below 4 mg/L. Nitrates in this area may be due to reclamation fertilization, high precipitation and a high water table in the spring of 1991 and drainage from an organically rich area immediately above the spring, fertilization of a newly constructed ditch, the heap leach, or the drain field adjacent to the plant area. Nitrate concentrations in Wells SBB 91-29 and SBB 91-30 were 27 mg/L and 14 mg/L respectively. These two wells were only sampled for nitrates once in November of 1991.

Below the leach pad on the south side, nitrate concentrations have increased in Spring 9 from below 1 mg/L to approximately 1.5 mg/L. Nitrate concentrations have increased in Well SBB 88-20 from 1 mg/L in 1988 to 3.2 mg/L in November, 1991. Nitrate concentrations increased in well SBB-87-13 from .6 mg/L in 1988 to 1.6 mg/L in 1992. Nitrate concentrations may be due to fertilization of the waste rock embankment. Spring 9, SBB 87-13 and SBB 88-20 also have elevated nitrate concentrations.

Figure 3 Map of BMMI Monitoring Locations



Nitrate concentrations have also increased in the vicinity of the main Beal pit. Water in Spring 5 contained 7.7 mg/L nitrate on November 1, 1991. Concentrations reached up to 12.5 mg/L on April 16, 1991. Nitrate concentrations at surface water station 3 averaged 1.85 mg/L in 1990 and 1.7 mg/L in 1991 and at station 3A averaged 1.2 mg/L in 1991. This increase is probably related to the blasting activities at the Beal Mountain main pit and waste rock pile. Water flowing from dewatering wells in the main Beal pit wall percolate through the floor of the pit and may carry nitrates to German Gulch. Analysis of algae samples from Stations 3 and 3A in German Gulch Creek tend to indicate unbalanced algal communities and a moderate degree of impairment to aquatic life (Loren Bahls, WQB memo, June 24, 1992).

Nitrate loading to German Gulch has been analyzed at Station 3A, which is downstream from all BMMI facilities. Nitrate concentrations at Station 3A were below the detection limit of 0.05 mg/L before mining began in 1988. Based on 1991 monthly flow data, nitrate loads at Station 3A were estimated to be 24.4 lbs/year, assuming that actual nitrate concentrations were one half of the detection limit. In comparison, the load of nitrate carried by German Gulch at Station 3A in 1991 was estimated to be 1,116.6 lbs/year, based on three water samples containing between 1.0 and 1.4 mg/L nitrate.

b. Aquatic Biology

Biological resources of German Gulch were inventoried in 1984 as part of the pre-mine baseline study and to support instream flow recommendations (MDFWP, 1984). Both periphyton (attached algal communities) and aquatic macroinvertebrates were inventoried in this analysis. Ongoing (operational) biological monitoring was not required, therefore, it is difficult to assess if changes in water quality have affected the biological communities in German Gulch. However, two periphyton samples were collected by the WQB in 1992 during routine field inspections and provide a basis for partial assessment on current conditions.

Biological sampling in 1984 was limited to German Gulch below the confluence with Edwards Creek to the mouth of German Gulch Creek. The 1992 samples were collected at Stations 4, 3A, 2A and Beefstraight Creek (see Figure 3). Table 3.1 shows the results of baseline and recent algal standing crop measurements measured in milligrams of chlorophyll-a per meter squared (mg chl-a/m^2). Relative to the 1984 samples, chlorophyll concentrations in recent samples appear to have increased. This increase is likely a result of the increased nitrogen concentration in German Gulch resulting from mine related activities. Standing crop measurements at the upper site should be lower than the downstream site since headwater streams are generally less productive and growth is limited by temperature (growing season), light, gradient and other factors.

Table 3.1 Mean Chlorophyll Concentration (mg chlorophyll-a per square meter) in Periphyton Samples Taken from German Gulch in 1984 and 1992

LOCATION	JULY 18, 1984	JULY 9, 1992	SEPTEMBER 1, 1992
Station 4 (upper GG)	–	–	68
Station 3A (below mine)	–	80	61
Station 2 (below Edwards Gulch)	32	11	–
Station 1 (below Beefstraight)	12	–	–
Station GG mouth	4	–	–

*GG = German Gulch

Algal growth becomes visible at concentration greater than 50 mg chl-a/m^2 and may impair other uses at concentrations greater than 100 mg chl-a/m^2 (Welsh, et al., 1988 and Nordin, 1985). Currently, no numeric criteria exist addressing algal growth, however, Montana Water Quality Standards prohibit the growth of undesirable aquatic life (ARM 16.20.633(1)(e)).

Diatom diversity declined from 4.22 in 1984 to 3.63 in 1992 at Site 2A on German Gulch (below Edwards Gulch). Diversity values tend to be lower in unproductive headwater streams and tend to increase with moderate increases in nutrient concentrations. Under excessive nutrient inputs, numeric dominance by a few undesirable taxa tends to decrease species diversity. Diatom diversity in ecologically similar streams ranged from 2.48 to 4.50 with a mean of 3.61 (Bahls, et al, 1992).

Periphyton community composition in German Gulch at the upper sites (4 and 3A) was dominated by a species of green algae (Ulothrix spp.) in 1992 (Bahls, 1992a and 1992b). This species was rare in earlier sampling and represents a change in community structure likely resulting from the increased nitrogen concentration. Community composition was relatively unchanged at Site 2A.

Periphyton samples collected from the upper reaches of German Gulch showed a moderate degree of impairment from sediment, as well as nutrients (Bahls, 1992a and 1992b). Aquatic macroinvertebrates and fish are also sensitive to sediment increases, however, biological monitoring has not been conducted to assess any change in these communities.

C. Wildlife

1. Biodiversity

This section examines the current status of biological diversity in the Beal Mountain Mine area. The agencies have taken a hierarchical approach to describing the existing environment. The broadest scale encompasses the Fleecer Mountain complex while the smallest scale is the hillside where the pits would be mined. We examined overall landscape patterns as well as habitats and wildlife species that may be affected by this project.

a. The Fleecer Mountain Complex

The Fleecer Mountain complex is a relatively isolated mountain range surrounded by lower elevation non-forested lands to the north, east, and south. To the west this complex is connected to the Pintler Range which is part of the Anaconda Pinter Wilderness. Elevations range from about 5,400 feet to 9,400 feet. The vegetation pattern and composition is typical of Eastside Rocky Mountain landscapes. Abrupt changes from grassland to forest habitat type characterize this mosaic. The lower elevations support grasslands and shrublands which merge into Douglas-fir type forests. Higher elevations support subalpine fir type forests which are dominated by lodgepole pine. The complex is managed by the DNF, Beaverhead National Forest, Mount Haggin State Game Range, and private owners.

The Fleecer Mountain complex supports approximately 1,500 elk and is one of the most heavily hunted areas in Montana (MDFWP, 1992). Human-caused disturbances already impact the entire complex. Turn of the century gold mining camps and works are evident in most drainages. Roads and trails access most of the area. Many of the drainages on the north end of the range have been placer mined. Timber harvest is evident throughout the range, and is ongoing on the Mount Haggin Game Range and in the Beaverhead National Forest portion of the range. The DNF is currently harvesting timber in this area.

b. German Gulch Landscape Patterns

According to the 1988 Beal EA, the Beal's Hill area contained "significant wildlife resources both in terms of wildlife populations and valuable habitat features. Most of the species common to the DNF can be found in the Beal's Hill area." Since 1988, the mine has impacted approximately 425 acres of forest/grassland habitat along with the associated riparian areas. Due to existing disturbance, discussed in Chapter 1, the mine site is not available for wildlife habitation. Big game and some bird species are found in the forests and grasslands adjacent to the mine.

The portion of the Fleecer Mountain Complex that encompasses the German Gulch drainage is essentially an island of forested habitat with less vegetative disturbance evident than elsewhere in the range. The block includes approximately 10 square miles of land that runs from German Gulch to Burnt Mountain, and Minnesota Gulch to Norton Creek. Large open parks within Douglas-fir and lodgepole pine forests characterize the German Gulch drainage. Most south facing slopes are grassy parklands while the area becomes more forested as aspect changes to the north. The German Gulch drainage was heavily impacted by turn of the century gold mining. Many of the riparian areas were placer mined and hundreds of people lived in the area.

The current level of human disturbance in the area of the proposed South Beal pits has already affected the capacity of the hillside to support wildlife. Currently, the site is crisscrossed with exploration roads and numerous test hole locations. Heavy equipment is routinely found working over the area.

c. Regional Linkages

Approximately 2 miles to the west and the north of Beal's Hill, open parkland begins to dominate the landscape. To the east and south, forest habitats interspersed with open meadows continue for 6 to 10 miles respectively. The Mill Creek Pass, 6 miles to the east of the project area, is the linkage between the Anaconda-Pintler Ranges and the Fleecer Range. This area is characterized by forested stringers in open grassland and shrubland habitats, and is bisected by State Highway 274 between Anaconda and Wise River. Elk use this linkage yearly, migrating from winter range along the east front of the Fleecer Range to summer range in the Mount Haggin area of the Anaconda-Pintler Range.

According to the main Beal EA, the Beal's Hill area is part of a migration corridor for elk, waterfowl, raptors, and migratory songbirds. German Gulch is one of the main conduits into the Fleecer Range from the north.

d. Edges

The unique microclimate along a major structural edge affects floral and faunal composition such that species diversity and density are often greater than in the communities on either side (MacArthur and MacArthur, 1961). The edge influence may extend several hundred feet into the forest community. Induced edges, such as those created by wildfire or roads, may select for edge-adapted species to the detriment of interior forest residents. Increased competition, predation, and nest parasitism are the factors that contribute to the decline of interior species when edge species are introduced.

Eastside Rocky Mountain forests are naturally fragmented and diverse at the between-habitat level. This is a function of dissected topography and broad elevational gradients. The agencies assume that most wildlife species present are native to this ecosystem, and are adapted to this relatively high complexity of habitat types.

The Beal's Hill area is characteristic of an eastside Rocky Mountain landscape. Abrupt edges occur between forests and natural parks. However, most edges in this landscape are less

abrupt than grassland to forest. Forest types blend together or different aged stands grow side by side. Most of these textural changes on the landscape are a function of topography, aspect, moisture, and soils. Fire historically played a role in shifting edges and these patterns are still evident today.

e. Riparian Areas and Associated Species Including MIS

Riparian areas include streams, ponds, swamps, wet meadows, sidehill seeps, and the habitats immediately adjacent to them (usually within 100 feet). Riparian areas are typically the most biologically diverse and productive of Rocky Mountain environments. They serve as reliable feeding areas for many species of wildlife and provide habitat that is diverse in structure and composition.

As discussed in the 1988 Beal application, the Beal's Hill area has many wet meadows and sidehill seeps. The area that would be disturbed by the S. Beal pits does not contain any seeps. Some of the Beal's Hill area seeps and wet meadows may be jurisdictional wetlands. During the course of the mine construction and subsequent exploration many of these sites have been impacted. Some have been destroyed but most have had mitigation measures taken to protect them as much as possible. This does not however insure that they are functioning as undisturbed riparian areas would. The headwaters of the German Gulch Drainage, where the mine is situated, have been adversely impacted by road construction and mining since 1988 (see surface and ground water discussions). Approximately 4 acres of stream habitat has been destroyed during mine operation. All of the stream habitat is in private ownership. The sidehill where the South Beal Project is located has some moist forest sites and sidehill seeps, mostly at contact points in the bedrock.

Beaver are present below the permit boundary where Beefstraight Gulch and German Gulch meet. No beaver sign is evident within the permit boundary. There are other species associated with riparian areas in this region. No surveys were performed for these species. However, this analysis assumes that historically the riparian sites within the permit boundary provided suitable habitat for them.

The DNF selected Management Indicator Species (MIS) for riparian areas are listed in the Forest Plan (1987). The presence, absence, and abundance of these species in a particular riparian site should indicate the quality of that area. This approach requires that these species be inventoried and monitored. It also assumes that these species accurately reflect riparian conditions and that baseline monitoring occurred. For the DNF these species are:

Shrub Riparian - Belted Kingfisher, Willow Flycatcher
Tree Riparian - Northern Water Shrew, Warbling Vireo
Wet Meadow - Western Jumping Mouse
Marshland - Blue-winged Teal

Belted Kingfisher (Ceryle alcyon)

Belted Kingfishers occur within the vicinity of the Beal's Hill area. They are relatively common along shrubby banks of the Clark Fork River (personal observation), 7 miles northeast. Habitat for this species is common throughout the German Gulch and Beefstraight drainages. Within the boundaries of the permit area, the only available habitat is along German Gulch Creek where fish populations provide a food base. There is no beaver activity above the permit boundary so stream depths are shallow and this may discourage Belted Kingfishers from foraging (generally diving headlong into the water from a hover in the air). Because of the current mine activity, 4 acres of shrubby riparian habitat is no longer available to Belted Kingfishers within the permit boundary. Belted Kingfishers were not surveyed for and none were detected during casual observation

Willow Flycatcher (Empidonax traillii)

The Willow Flycatcher is found in low to mid-elevation deciduous riparian thickets and wet meadows. They can also inhabit open brushy slopes, dry shrubby uplands, and forest openings below 7,000 feet (USFS, 1990). Below the permit boundary much of German Gulch is appropriate habitat for Willow Flycatchers. Above the boundary, 13 acres of habitat was available however, 4 acres (31 percent) have been removed because of mining activity. Suitable upland habitats such as shrubby slopes are not common and the permit area lies at the 7,000 foot level, probably limiting Willow Flycatcher abundance. Willow Flycatchers were not surveyed for and none were detected during casual observation.

Northern Water Shrew (Sorex palustris)

The Northern Water Shrew inhabits small cold streams with cover on the banks (Burt and Grossenheider, 1976). German Gulch Creek provides the only habitat within the permit boundary. Past and present mining impacts have probably limited the Northern Water Shrew habitat along this creek. Four acres are totally unavailable and the remaining 9 acres do not have the heavy cover along the streambanks that makes desirable habitat. Northern Water Shrews were not surveyed for and none were detected during casual observation.

Warbling Vireo (Vireo gilvus)

The Warbling Vireo requires open deciduous and mixed deciduous-coniferous forests, especially streamside vegetation, but also groves and scrubby hillside trees. It prefers forests with a substantial forb or shrub layer and low to intermediate canopy cover (DeGraaf et. al., 1991). Suitable habitat occurs for Warbling Vireos in Beefstraight Gulch, American Gulch, and parts of German Gulch. Some stretches of German Gulch Creek within the permit boundary have suitable shrubby forested cover. Mining has made 31 percent of the habitat within the boundary unavailable. Warbling Vireos were not surveyed for and none were detected during casual observation.

Western Jumping Mouse (Zapus princeps)

The Western Jumping Mouse inhabits areas near streams with lush grass and forb growth (Burt and Grossenheider, 1976). German Gulch Creek within the permit boundary does not have this sort of thick grass/forb characteristic. The stream channel is composed of exposed rock with a steeper gradient than areas that generally have heavy grass/forb cover. Mining activity has also modified the stream channel, turning over the cobble bottom and leaving it along the edges of the riparian zone. Some hillside wet meadows that existed where the leach pad is today may have supported Western Jumping Mice. The slope where the South Beal Project is proposed does not have any suitable habitat. Western Jumping Mice were not surveyed for and none were detected during casual observation.

Blue-winged Teal (Anas discors)

Blue-winged Teal prefer fresh water marshes, rivers, and ponds with moderate cover. They also prefer calm water or sluggish currents rather than fast water (USFS, 1990). Below the permit boundary there is suitable habitat for Blue-winged Teal in the beaver ponds along Beefstraight Gulch. There is no suitable habitat within the permit boundary. This area is within a migration corridor for waterfowl that often stop over at the Warm Springs Ponds about 12 miles to the north. It is possible that Blue-winged Teal could be attracted to any holding ponds created by the mine. Blue-winged Teal were not surveyed for and none were detected during casual observation.

f. Lodgepole Pine/Douglas-fir and Associated Species Including MIS

The forested habitats that the current mine and exploration have impacted are primarily lodgepole pine (subalpine fir series) and Douglas-fir. The hillside where the proposed expansion is located is occupied by lodgepole pine with pockets of subalpine fir.

Within timber compartments 406 and 407 where the permitted area is located, there are 12,251 forested acres and 2,996 grassland acres. Seventy-nine percent of the forested acres are mature stands (trees greater than 9 inches diameter at breast height (Table 3.2). The forest species composition is dominated by lodgepole pine with 7,244 acres of Lodgepole pine habitats, 1,183 acres of Douglas-fir, and 1,393 acres of spruce/subalpine fir. The DNF has listed the Hairy Woodpecker as the Management Indicator Species for Lodgepole pine forests.

Table 3.2 Forested and Nonforested Habitat Acres Within Timber Compartments 406 and 407

	Compartment 406	Compartment 407	Combined
Forest			
Seedling/sapling	0	0	0
Pole Timber	611	1948	2559
Mature Timber	4685	5007	9692
Subtotal	5296	6955	12251
Nonforest			
Dry Meadow	534	2335	2869
Wet Meadow	56	71	127
Subtotal	590	2406	2996

Hairy Woodpecker (Picoides villosus)

The hairy woodpecker can occur in lodgepole pine, ponderosa pine, subalpine fir, and mixed conifer stands (Harvey-Eightmile EIS). During field reconnaissance within the permit boundary, woodpecker activity has been observed only on the south and east facing slopes of German Gulch. This was found within Douglas-fir stands and Hairy Woodpeckers were not specifically identified. In the lodgepole pine stands on the north side of the Gulch, no woodpecker activity was recorded. Surveys specifically for Hairy Woodpeckers were not conducted and no casual sightings were recorded.

g. Old-growth and Associated Species Including MIS

Old-growth forests provide complex environments valuable to wildlife because of their high biomass, structural complexity, and variety of microsites. Old-growth forests vary in composition and structure depending on the dominant species in the stand. Douglas-fir old-growth is much different than Subalpine fir old-growth.

The project area straddles the boundary between timber compartments 406 and 407. The DNF identified potential old-growth stands for both timber compartments using aerial photos and the timber stand management record system. The DNF used two parameters of the Eastside old-growth definitions (USFS 1992) to determine which stands were identified. The definitions vary according to habitat type and take into account the age of the dominant tree species, the density of large diameter trees, the density of snags, the frequency of broken and dead-topped trees, the abundance of woody debris, the degree of vertical layering, and the presence of gaps and patches. The only components of the criteria we used were large tree diameter and age. This

method identifies potential old-growth, but only field review can verify which of these stands have all old-growth characteristics. In addition, timber information was not taken for all stands in the compartments. Some stands that contain large trees may be missing from this analysis. Therefore, this information is a best guess of stands with potential to be or become old-growth.

In this analysis the DNF broke old-growth out into Douglas-fir, lodgepole, and small spruce/subalpine fir according to the age of the stand (Table 3.2). In order to qualify as old growth, Douglas-fir had to be older than 200 years, lodgepole pine older than 150 years, and spruce/subalpine fir older than 160 years. The DNF also delineated Douglas-fir 150 to 200 years old as sites that may hold some old-growth characteristics but do not meet the age criteria. There are 60 stands or 1,898 acres that are old enough to have old-growth characteristics. Some of these stands are adjacent to one another and form complexes of older forest habitats while some single units are scattered across the compartments. These areas range in size from 3 to 260 acres (Figure 1). Older lodgepole pine was the most common potential old-growth type followed by 150-200 year old Douglas-fir, 200+ year old Douglas-fir and spruce/subalpine fir (Table 3.3).

Table 3.3 Acres in Timber Compartments 406 and 407 Suspected to be Old-growth by Species and Age

Species/Age	Compartment 406	Compartment 407	Combined
Lodgepole Pine/150+	258.02(50)	816.53(59)	1,074.55(57)
Douglas-fir 150-200	63.60(.07)	372.78(27)	376.38(20)
Douglas-fir 200+	174.45(34)	145.55(11)	320.00(17)
Spruce/Subalpine-fir	83.93(16)	43.22(3)	127.15(7)
TOTAL	520.71(100)	1,377.62(100)	1,898.33(100)

Suspected old growth made up 15.5 percent of the timbered component of compartments 406 and 407, not including Douglas-fir under 200 years old (Table 3.4). Forest Plan Standards require that 5 percent of each 3rd order drainage must be old-growth. German Gulch drainage is a 3rd order drainage and for the purposes of this document, percentage of old-growth within timber compartment 406 should meet this standard.

Table 3.4 Percent of Old-growth by Species Within Timber Compartments 406 and 407

	Compartment 406		Compartment 407		Combined	
Species/Age	Total Acres	% Old Growth	Total Acres	% Old Growth	Total Acres	% Old Growth
Lodgepole Pine	3,890	6.7	3,354	24.3	7,244	14.8
Douglas-fir	739	23.6	444	32.8	1,183	27.1
Spruce/Subalpine-fir	781	10.8	612	7.1	1,393	9.1
All Species	5,410	9.6	4,410	22.8	9,820	15.5*

*This analysis portrays the most optimistic percentages within the compartments. These stands do not necessarily have all the characteristics that define old-growth.

Current mine exploration has impacted one Douglas-fir old-growth stand. This stand has been field verified and meets the eastside Douglas-fir old-growth criteria. A series of exploration roads has been constructed through this 37 acre stand, and some 200-300 year old trees have been removed. Currently, this stand is being fragmented by roads. If an ore deposit is located within this area the entire stand will be removed (Bio. Rept. Expl. Roads 1991, 1992).

The Northern Goshawk has been identified as an indicator species for old-growth habitats on the DNF. However, goshawk population trends are also of concern because of declining numbers. As a result, the U.S. Fish and Wildlife Service has listed them as a Category 2 Species under the Endangered Species Act. (See Threatened, Endangered, and Sensitive Species discussion for discussion of Category 2.)

Northern Goshawk (Accipiter gentilis)

Goshawks are forest raptors. They prey on squirrels and forest birds and typically nest in stands of mature and old-growth forest larger than 25 acres (Warren 1990). Nesting habitats have consistently been described as mature to old-growth forest stands (Reynolds 1978, Hennessy 1978, Hall 1982, Saunders 1982, Hayward 1983, Crocker-Bedford 1990). Both single and multi-storied stands with relatively open understories are used (Dietzen 1978, Hennessey 1978, Shuster 1980, Hall 1982).

Goshawks select nesting trees large enough to accommodate a substantial nest structure. Hayward (1983) found goshawks in the northern Rockies using nest trees averaging 20 inches dbh. Douglas-fir and western larch are preferred nesting trees in this region (Warren 1990). Nest sites most frequently occur toward the bottom or on the lower 1/3 of gentle slopes (Hayward and Escano 1989), and they are often located next to small canopy openings that provide a flight path to the nest (Hayward 1983).

Ideally, foraging stands should be at least 2500 acres in size (Reynolds 1983). Crocker-Bedford (1990) described prime goshawk foraging habitat as extensive stands of large trees with dense canopy and open understory. Population densities of goshawks in western North America vary widely depending on the distribution and extent of suitable habitat. These estimates range from one pair per 525 acres in Wyoming (Craighead and Craighead 1956) to one pair per 6800 acres in Oregon (Reynolds and Wight 1978). Crocker-Bedford (1990) has suggested managing for about 5000 acres of prime habitat per nesting pair.

The Beal's Hill area does have adequate habitat for northern goshawks to forage and reproduce. The mature-to-old forest component of timber compartments 406 and 407 covers 79 percent of the forested area. Specific analysis for goshawk habitat within the timber compartments was not conducted because of time constraints. Analysis was confined to land within the permit boundary. Within the permit boundary there were 37 acres of open grown old-growth habitat that had potential as nesting and foraging habitat. This is the Douglas-fir old-growth stand described above. Goshawks were not surveyed for and were not seen during field reconnaissance. The South Beal Project location supports mostly small diameter dense lodgepole pine with a myriad of exploration roads already in place. It is not suitable habitat for goshawks.

h. Grassland and Associated Species Including MIS

There are 2,869 acres of dry grassland in timber compartments 406 and 407. Approximately 7.8 percent of that grassland is within the permit boundary. Grasslands within the permit boundary are not grazed by domestic livestock, and if not altered by current mine operation, are available to grassland associated wildlife species (Appendix A).

The DNF has listed the Montane Vole as a Management Indicator Species for mountain grassland habitat (FP V-6).

Montane Vole (Microtus montanus)

The montane vole is found in natural bunchgrass communities interspersed with forested stands on south and east-facing slopes (Harvey-Eightmile EIS). They require overhanging grass as cover and building material for tunnels. Grass is also a primary food source (Burt and Grossenheider 1978). Within the permit boundary, 91 acres of dry grassland habitat exist. About 133 acres of the original grasslands have been converted to roads and bare soil due to mine activities. Studies on the Mount Haggin Game Range 3 miles to the north of the permit boundary documented montane voles in the grasslands (R. Douglas, pers. comm. 1991). Because of the condition of the grasslands within the permit boundary and the proximity of known populations of this species, it is reasonable to assume that this species is present in the project area. Habitat is not present in the proposed South Beal Project area. There have been no population surveys for montane voles conducted and no casual observations recorded within the permit boundary.

2. Specific Species of Interest

a. Elk

According to the original EA for this area (USFS 1988) the High Rye Elk herd unit, a component of the larger Fleecer/Mount Haggin herd, is about 500 animals during the winter. This herd winters in the Beefstraight Creek and Norton Creek areas and summers around Beal's Hill. High use summer habitat also includes the Greenland Gulch area. Prior to the current mine activity, Beal's Hill was a elk calving area. Since the mine operation began, calving has shifted away from the mine site. The Beal's Hill area still offers transitional range during the fall and because the habitat within the permit boundary is closed to hunting, elk are commonly found within the area during the hunting season. The habitat not directly impacted by mine activity continues to be occupied by elk.

The DNF Plan provides two indices for measuring elk habitat effectiveness: elk use potential (EUP) and elk effective cover (EEC). Elk use potential is a measure of hiding cover and assumes that a ratio of 40 percent cover to 60 percent open habitat is an optimal balance. This is defined as 100 percent EUP. Elk effective cover is determined by multiplying EUP by a factor derived from open road density (habitat effectiveness). A EEC of 100 percent is optimal.

This area is within Elk Hunter Recreation Opportunity Unit (EHROGA) #20. The Deerlodge Forest Plan sets minimum hiding cover at 36 percent, minimum EEC at 70 percent, and the maximum road density at 0.5 mi/mi^2 for this unit (Forest Plan N-7).

Existing hiding cover in this EHROGA is at 39.5 percent and road density is at 0.40 mi/mi^2. This combination creates an EEC within Forest Plan standards (Table 3.5). Road density currently calculates only those roads open during the hunting season. If the area is analyzed according to the terms of a 1988 settlement agreement reached with appellants to the DNI plan, closed roads receive 0.25 weight in the road density equation. Then this area has a road density of 0.59 mi/mi2.

Table 3.5 Hiding Cover and Road Density Calculations for the High Rye EHROGA - Beal Mountain Mine Analysis

EHROGA	ACREAGE	% HIDING COVER	% ELK USE POTENTIAL	TOTAL ROAD DENSITY (mi/sq.mi)	OPEN ROAD DENSITY (mi/sq.mi)	% ELK EFFECTIVE COVER
Existing High Rye	26,470	39.5	100	1.2	0.4	81
Minimum Forest Plan Standards	---	36	95	no standards	0.5	70

Evaluation of Security Areas

A security area, by virtue of its geography, topography, vegetation, or a combination of these factors, will hold elk during periods of stress (Lyon and Christensen 1990). The security area concept was designed to provide elk with enough cover and seclusion during the hunting season to allow a desired number of mature bulls to escape harvest. Hillis et al (1991) defined the objectives for security areas as 1) Maintaining the current, relatively unregulated 5-week hunting season; 2) distributing the bull harvest evenly over the entire hunting season; and 3) maintaining a desired level of mature bulls in the post-hunting season population.

Currently, no hunting is allowed within the permit boundary. Elk have become somewhat habituated to the mine operation, and do use remaining habitat within the permit boundary. This habitat is functioning as a security area for this herd unit. Within the High Rye EHROGA 82 percent of the forested cover is more than 1/2 mile from a road.

b. Mule Deer

According to the original EA (USFS 1987), mule deer concentrations in the area are moderate. It provides year-round habitat for mule deer, and the ridge below the mine site is excellent deer habitat. The current mine activity probably displaced mule deer from the immediate vicinity of disturbance, but deer are still present within the permit boundary and use the hillsides adjacent to the mine including the site where the South Beal Project is to be located.

c. Blue Grouse and Spruce Grouse

Blue Grouse and Spruce Grouse are reverse migrants moving from high elevation to low for summer and low elevation to high during winter. Insects and forbs are eaten during spring/summer, berries are added during fall, and conifer needles are the main food source in winter. Both Blue Grouse and Spruce Grouse occupy the area around Beal's Hill year round. The leach pad for the current mining operation is situated on spring/summer habitat for grouse where broods were raised (USFS 1988). The South Beal Project site may provide winter habitat for these species.

d. Threatened, Endangered, and Sensitive Species

Threatened, endangered, and sensitive species are characterized by low populations that are often erratically distributed. As a result, they play diminished roles in the natural communities of which they are a part. Because of their sensitivity to human activities and to changes in the landscape, they are the components most likely to be lost from the system. Biological diversity suffers as a result.

Threatened and endangered species are listed and monitored by the U.S. Fish and Wildlife Service. An endangered species is one that faces the possibility of extinction throughout all or a significant portion of its range. A threatened species is one that is likely to become endangered in

the foreseeable future. A candidate species is one being studied for listing (category-1 = species for which substantial data is available; category-2 = species for which data is being gathered).

Sensitive species are not covered under the Endangered Species Act and are not administered by the USFWS. They are designated by the Forest Service (the Regional Forester in each region), and are species for which population viability is a concern. Downward trends in population numbers or in habitat capability (either observed or predicted) are evidence of viability problems.

There are 8 threatened, endangered, and sensitive wildlife species known or believed to occur in the project area (Table 3.6). One Category 2 species, the Northern Goshawk was dropped from this section. It is analyzed separately and carried through the document as an old-growth Management Indicator Species. More detailed information on threatened, endangered, and sensitive species is documented in the Biological Evaluation found in Appendix A.

Table 3.6 Threatened, Endangered, and Sensitive Species Known or Believed Likely to Occur in the Beal's Hill Area

COMMON NAME	SCIENTIFIC NAME	USFWS STATUS	USFS-R1 STATUS
ANIMALS:*			
Peregrine Falcon	Falco peregrinus	Endangered	Endangered
Bald Eagle	Haliaeetus leucocephalus	Endangered	Endangered
Lynx	Lynx canadensis	Candidate-C2	Sensitive
Fisher	Martes pennanti	None	Sensitive
Boreal Owl	Aegolius funereus	None	Sensitive
Flammulated Owl	Otus flammeolus	None	Sensitive
Townsend's Big-eared Bat	Plecotus townsendi	Candidate-C2	Sensitive
Black-backed Woodpecker	Picoides arcticus	None	Sensitive

* Species known to occur in the area

D. Fisheries

The proposed project area is within the German Gulch drainage. German Gulch supports a pure strain of west slope cutthroat trout. Westslope cutthroat trout populations were estimated in 1984 at 525 fish 6-10 inches in length per mile of stream near Beefstraight Creek and 230 westslope cutthroat 6-10 inches in length per mile of stream near Edwards Creek. Field reviews conducted in 1988 indicated that fish distribution in German Gulch extends upstream into the SE 1/4 of section 33, approximately 1 mile below the permit boundary. Recent observations indicate the presence of fish in the vicinity of water monitoring Station 3A which is located just upstream of the permit boundary. However, species composition, abundance, and extent of upstream distribution has not been documented.

Historic placer mining occurred extensively in German Gulch Creek. This has likely reduced quality of fisheries habitat due to channelization alteration of channel characteristics and riparian vegetation communities. Despite these historic alterations of habitat, German Gulch supports fish

populations similar to those found in nearby streams. Evaluation of stream substrate in 1988, upstream of Beefstraight Creek, yielded measurements of 34.5% cobble embeddedness and 41.6% fine sediment (< 0.25 inch).

Baseline investigations conducted prior to operations indicated water quality in German Gulch to be good to excellent. As discussed in the Surface Water section, water quality monitoring indicates that TDS, nitrates, and sulfates have increased in German Gulch since the baseline data was collected. Field investigations by the MDHES Water Quality Bureau indicate that construction activities in the vicinity of the mine have contributed sediment directly to German Gulch. These effects decrease below the permit boundary as additional flow enters the stream, with recovery observed in the location of water monitoring Station 2 approximately 2 miles downstream of the permit boundary.

E. Resources With No Significant Impacts

1. Soil Resources

Soils in the proposed amendment area are similar to those found at main Beal and discussed in the main Beal operating permit application and 1988 Beal EA. The soils are acidic to neutral with pH values ranging from 4.5 to 7.0. The soil pH values are naturally occurring because of the vegetation community on the site and not related to the presence of the ore body in the area. Vegetation communities in the area of the expansion are adapted to growing on the acidic soils and perpetuate acidic soil conditions. Although a soil pH of 5.0 or less may produce limited revegetation, it is not considered unsuitable for salvage by the agencies.

2. Vegetation

The project would disturb over 25 acres of forested ground in German Gulch. The interdisciplinary team from the agencies reviewed the potential impacts to vegetation and concluded that destruction of that 25 plus acres of forest land would not create large impacts to wildlife use of the area. A detailed discussion of vegetation and communities is in the biodiversity discussion under Wildlife.

There are no Threatened or Endangered plant species in the South Beal area. One known sensitive plant species is found within the existing mine operating area; Juncus hallii (Hall's rush) was found during Beal Mountain Mine's baseline vegetation studies. Portions of the populations of that species has been protected from disturbance by BMMI. BMMI planted 500 plants of Halls' rush on the mine site disturbances in 1989 as a further mitigation. Neither Hall's rush nor any other sensitive plant species or sensitive plant communities were found during field surveys in 1992 of the South Beal proposed expansion.

3. Air Quality

BMMI already has an air quality permit for the Beal Mountain Mine. The Air Quality Bureau has previously modified the air quality permit to accommodate this mine expansion (Air Quality Permit #2472-02, issued February 18, 1992).

4. Recreation

The Beal Mountain area is classified in the Forest Plan, Chapter III-54, as an E1 management area which, under recreation, allows for the construction of trails and facilities that provide access to adjacent areas. The Beal Mountain area was inventoried using the Recreation Opportunity Spectrum, a system designed to inventory, analyze, and manage forest recreation settings and opportunities. Under this system, the Beal Mountain area was inventoried for rural and roaded natural setting classification where resource modification and utilization practices are

evident, but harmonize with the natural environment. This is characterized by broad, rounded, and smooth mountain ridges and narrow v-shaped valleys. Vegetation habitat types consist of Douglas-fir, Englemann spruce, and subalpine fir.

Trail #94 accesses the area on the north side of German Gulch and continues around the perimeter boundary of the Beal Mountain Mine. The trail continues south across Greenland Gulch and connects to the Continental Divide National Scenic Trail. Hunting is the primary recreational activity in the area. Hunters access the area mainly by off highway vehicles or horseback.

Most of the trail is not within sight of the proposed project area. Hunters primarily use German Gulch to access the Greenland Gulch area. The South Beal expansion is within the permit boundary of the mine which means it is currently off limits to recreational uses.

5. Cultural Resources

The project area is in the German Gulch Historic Mining District. Extensive cultural resource inventory of German Gulch and the proposed project area began in 1981 when BMMI began mineral exploration and contracted with Mineral Research Center of Butte, Montana to conduct cultural resource investigations (Fredlund, 1990). Further inventory took place as exploration increased and culminated in the development of the Beal Mountain Mine. Cultural resource inventory reports produced from surveys conducted in the German Gulch area include: Fredlund, 1990; Herbort, 1988; Herbort, 1984; Fredlund and Anderson, 1984; Steer, 1982. Each of the above surveys, in whole or combination, covered all of the potential impact area for the South Beal Project. Fredlund's 1990 report covered mitigation, but gives valuable information about the entire historic district. In addition, as part of project monitoring and field investigations, the DNF archeologist has walked over the entire project area.

Extensive adverse effect to major contributing elements of the historic district by road construction at main Beal resulted in GCM Services being contracted by BMMI to mitigate impacts, through a series of test and mitigation excavations, in order to retrieve valuable archaeological information. The mitigation also included archival research into the history of Chinese and Euroamerican placer mining. The resulting mitigation report Archaeological Investigations In the German Gulch Historic District (24SB212): An Historical Chinese Placer Area in Southwestern Montana, presents good artifact analysis and discussion of placering techniques. Please see the above referenced report for additional details.

CHAPTER IV - CONSEQUENCES OF THE PROPOSED ACTION AND ALTERNATIVES

This chapter discloses the potential effects of the alternatives discussed in Chapter 2 on the resources described in Chapter 3 and forms the analytic basis for the comparison of alternatives in Chapter 5. The chapter is organized by resource.

A. Geology and Engineering

1. Alternative 1 The South Beal Project

Direct and Indirect Effects:

a. Geochemical characterization

The rocks associated with the South Beal deposit consists of quartzite/hornfels and marble. The host marble bed is 50 to 90 percent diopside/wollastonite. The quartzite/hornfels rock makes up about 86 percent of the total overburden waste rock. A portion of the waste is iron oxide stained. One 10- to 15-foot thick fine-grained quartzite bed has up to 5 percent disseminated sulfides. Due to the presence of these sulfides, the potential for acid generation exists.

Formation of acid rock drainage is a complex process. The long-term chemical nature of water leaching through spent ore and waste at mining properties depends on a variety of chemical reactions. The most important reactions affecting mine water quality are the oxidation of iron disulfides, formation of acid, and the dissolution of buffering minerals which can neutralize, decrease or delay acid production.

Geochemical material characterization tests for the main Beal and South Beal deposits indicate a low potential for acid formation and subsequent release of metals into surface waters. However, the release of sulfates and arsenic into surface waters is still considered to be a possibility. These substances could become mobile regardless of acid production. If acid rock drainage were to develop over time the consequences would have long-term impacts on German Gulch. Those long-term impacts are discussed in the section on Surface Water in this Chapter. Any release of arsenic, or other toxic and deletenious substances to surface water would violate the MT Water Quality Act.

Methodology

A number of geochemical tests were used to estimate the water quality impacts of the various mine waste materials. Trace element analyses were conducted for 2 quartzite waste samples, 3 marble waste samples and 4 South Beal ore samples to determine trace element abundance. The observed concentration of these trace elements/metals above background levels is common for mineralized areas.

EPA Method 1310 tests (E.P. Toxicity) were conducted on the same selected samples. E.P. Toxicity analyses were used to evaluate whether or not any substantial amounts of regulatory controlled metals would be leached under this testing protocol. E.P. toxicity analysis is also used to classify waste as hazardous or not hazardous. Water quality may be impacted at lower levels.

Samples of ore and waste rock from the South Beal deposit and spent ore from the main Beal leach pad were tested for their acid producing potential using the modified Sobek method, a static test, in which the acid producing potential of a rock is compared to the neutralizing potential (Reclamation Research Unit, MSU and Schafer & Associates, 1987). The acid neutralizing potential (ANP) minus the acid producing potential (APP) is defined as the Acid-Base Account (ABA). Another method of evaluating the potential for acid production is to ratio ANP/APP. If the ratio is greater than 3, it is generally accepted by the scientific community that the risk for eventual acid

production is very low.

A kinetic test is a type of leachate extraction test. Acid production or sulfate production during kinetic tests are indicators of acid producing potential. Kinetic tests define reaction rates for both metal dissolution and acid generation through time under specific conditions. Ultimately true prediction of long-term drainage quality is only possible through qualitative math models which can reliably extrapolate kinetic test results beyond the time of the tests. These models are not available to the agencies and BMMI did not provide the extrapolation analysis.

South Beal Waste

Trace element analyses were performed on three South Beal marble waste samples and two quartzite waste samples. Although trace element analyses indicated similar elevated concentrations of trace elements/metals, the corresponding leachate extraction tests did not indicate any potential for metals release into the environment.

BMMI conducted static tests on twenty-two South Beal waste rock diamond drill core samples: twelve for quartzite waste, six for marble waste and four for iron oxide waste. These samples were taken from what would eventually be the exposed highwall and pit floors. All but one waste rock sample had ABA values near or above zero, suggesting the lack of potential to produce acid.

The ANP/APP ratios showed that all marble waste samples and iron oxide waste samples had an ANP/APP of greater than 3, indicating a very low risk of any acid formation. Kinetic testing affirmed the static test results; results demonstrate that the marble waste from the South Beal deposit would not produce acid and may even act to neutralize any effluent. This is the same material which could be used to isolate or cap potentially acid-producing waste.

For the quartzite waste, 75 percent of the samples had an ANP/APP of greater than 3. Results from the static testing could not confirm that all quartzite waste would be non-acid producing. Therefore, kinetic testing, using humidity cells, was conducted for 15 weeks. Sulfate was initially released but eventually levelled off at the end of 15 weeks of testing. These results also indicate that the South Beal quartzite waste would not be acid producing.

Main Beal Waste

No geochemical characterization results were available for review. Currently sulfate concentrations in springs emanating from below the main Beal waste rock dump are increasing. This could either be due to dissolution of gypsum incorporated in the rock, dissolution of soil amendments, application of a sulfate used for chemical dust abatement, or the oxidation of iron disulfides and the subsequent production of sulfates. Ongoing water monitoring results will indicate which scenario is most likely. The agencies are closely monitoring sulfate concentrations and are working with Beal to reevaluate the characteristics of the main Beal waste.

South Beal Ore

Trace element results conducted on four South Beal ore samples indicated trace element/metal compositions for arsenic, barium, chromium, copper, iron, manganese and zinc were elevated above background levels.

Leachate extraction tests using EPA Method 1310 were conducted on the same four South Beal ore samples. This leachate extraction technique was used to evaluate if any substantial amounts of regulatory controlled metals would be leached under this testing protocol. After the extraction, no leachate samples had concentrations of metals above regulatory limits for this test. Results indicated that metals mobility should be minimal.

Six ore samples were taken from diamond drill core from the South Beal deposit. Static tests were conducted on these samples. The static test results suggest an uncertainty as to whether acid formation from ore would eventually become a problem. Kinetic tests were not done on fresh ore from the South Beal deposit because the ore would be limed in the agglomeration process, prior to cyanidation and results could be inconclusive.

Main Beal Spent Ore

Trace element analyses were not done on main Beal spent ore.

Static tests were done on three spent ore samples taken from the main Beal leach pad. Results from these tests again suggest an uncertainty as to whether sulfate release and metals leaching would eventually become a problem.

To help resolve this uncertainty, kinetic testing was conducted for 15 weeks on the main Beal spent ore samples using humidity cells. Three cells were constructed: 1) whole spent ore, 2) less than 2mm diameter spent ore, and 3) greater than 2mm diameter spent ore. All humidity cell samples released sulfate during the initial leaching cycles suggesting that gypsum, hydrated calcium sulfate accumulated during processing, was being released. Unlike tests done for waste samples, sulfate continued to be released for all three spent ore samples, indicating a possibility of oxidation of iron disulfide. These tests should have been continued for at least 5 to 10 more weeks to help define the source for the sulfate release.

A chemical analysis of humidity cell leachate extracted after the ninth week of testing indicated the possibility of arsenic mobility. The leachates were not analyzed for metals at the end of testing. Therefore, testing results were inconclusive regarding the potential for arsenic mobility.

No samples tested produced an effluent with a pH lower than 8.13 after 13 weeks of testing. However, the pH trend analysis for the spent ore sample of greater than 2mm indicated a substantial drop in the last 2 weeks of testing from 8.24 to 6.4.

Direct and Indirect Effects:

b. Engineering

(1) South Beal

The extensive fracturing and weathering of the quartzite/hornfels rocks in the South Beal area make the slope potentially unstable. Excavation of the South Beal pits would create large, but relatively flat, cut slopes. These cut slopes could be susceptible to some short-term, minor erosion (1-2 years). Eroded soil would be caught within the pit, and would not reach an active stream channel. During development of the deposit, stability of the highwall may be a problem in the open pits, especially if the highwall becomes saturated. If the highwalls were to fail, a greater area may require stabilization, recontouring and revegetation. Stabilization may be more difficult with a failed slope. Small failures from isolated wet spots would not cause any long-term effects on BMMI's ability to reclaim the South Beal area.

BMMI's proposed mitigation measures should prevent any major failure of the pit highwalls. BMMI's mitigation measures include 1) snow removal before spring thaw, 2) horizontal dewatering wells drilled into the completed pit slope to reduce static water pressure, and 3) a diversion ditch constructed around the top perimeter of the pit if necessary. Mining may occur during the wet season and increase the potential for instability of the highwall if these mitigation measures are not implemented.

The change in topography from an undisturbed wooded hillside to an open pit would be a

short-term impact. The pits would be backfilled and reclaimed to near original topography during the summer following ore removal. This would eliminate most erosion potential and would eliminate any long-term stability impacts associated with pit excavation.

(2) Main Beal

The addition of approximately 1 million tons of ore on the existing heap leach pad would slightly increase the reclamation cost of the heap, but would not affect the stability of the heap. The addition of South Beal ore to the heap would bring the total mass of the heap to slightly less than 11 million tons, including main Beal ore that is yet to be mined. The heap stability analysis and design was done to allow for increased loading up to a total height of 75 feet, and total mass of 11 million tons. The addition of South Beal ore to the heap leach pad would not make the heap larger than what was designed and analyzed by the engineering consultant.

The waste dump size would not be increased by adding waste from the South Beal pits. The same amount of waste that would be added to the waste dump from the South Beal pits would be used from the main Beal pit to back fill the South Beal pits. The size of the waste dump would actually be decreased by mining the South Beal deposit because waste from the main Beal pit would take the place of waste and ore removed from the South Beal pits. The impact of South Beal ore on the heap would be minimal and the impact of South Beal waste on the waste dump would be reduced.

2. Alternative 2 The South Beal Project with Modifications

a. Geochemical Characterization

Direct and Indirect Effects:

Impacts from Alternative 2 would be the same as impacts from Alternative 1. However, the agencies would have more data to identify sources of potential contamination. Waste rock dump monitoring and field and kinetic tests would help define the potential for contaminant leaching.

b. Engineering

Direct and Indirect Effects:

Alternative 2 would have similar effects on the stability of the South Beal slope, main Beal heap, and waste rock dump as Alternative 1.

3. Alternative 3 The No Action Alternative

a. Geochemical Characterization

Direct and Indirect Effects:

The No Action alternative would result in no change from current conditions. Ore and waste being mined from the main pit would be monitored for acid producing potential using the geochemical characterization plan discussed in the South Beal proposal. The plan is not part of the main Beal permit and BMMI could choose to stop implementing the characteric plan at any time. The high-neutralization-potential marble waste from the South Beal area would not be available for buffering or isolation of any potentially acid-producing wastes from the main pit.

b. Engineering

Direct and Indirect Effects:

The No Action alternative would leave topography and geology in the area of the South Beal pits in their present natural condition. Soils on the South Beal slope would continue to creep.

Mining would continue in the main Beal pit as currently permitted. The heap leach pad would ultimately be 60 feet high and hold 10 million tons. The waste rock dump would continue progressing as currently permitted and would contain approximately 1 million tons more than if the South Beal Project was granted.

4. Cumulative Geology and Engineering Impacts for All Action Alternatives

a. Geochemical Characterization

The cumulative effect of Alternatives 1 or 2 would be to improve reclamation capping of the main Beal waste dump and possibly the leach pad, using marble waste from South Beal.

The addition of the South Beal waste rock to the waste rock dump would not increase the potential for acid rock drainage because South Beal waste is not expected to produce acid. In fact, the addition of the South Beal marble waste rock may neutralize some of the potential for acid rock drainage from the main Beal waste rock. The cumulative effect of Alternatives 1 or 2 for the waste dump would be to decrease infiltration of water into the dump and to buffer any acidic water that might be produced.

Reasonably foreseeable development at the property includes taking the main Beal pit 200 feet deeper, and generating an additional 1.5 million tons of waste rock. Any nitrate or sulfate problems emanating from the waste rock would be accentuated proportionally by this additional waste. Should acid generation problems be indicated, the marble waste from South Beal would be available for mitigation.

There would be minor cumulative effects from the addition of the South Beal ore to the main Beal ore. Static and kinetic results suggest that the main Beal ore might release sulfates and arsenic. The South Beal ore is geochemically similar to the main Beal ore and it is reasonable to assume the South Beal ore, after cyanidation and agglomeration, would also release sulfate and arsenic.

For spent ore, although the potential for acid production is small, arsenic is mobile under a greater range of pH and an additional mass of arsenic would be supplied to the heap. Since the leach pad is on a lined surface and the effluent would be controlled, the effects of deposition of additional arsenic on the leach pad would be minor for the short-term. At final reclamation this increased ore would contribute to the total mass of arsenic available for release.

The reasonably foreseeable deepening of the main Beal pit would generate an additional 4.5 million tons of ore. This would require a new amendment, and would necessitate increasing the permitted capacity of the leach pad again. Any leachate problems with this additional ore would be cumulative with those resulting from the ore from the main and South Beal pits and would be addressed in an environmental analysis for the new project.

b. Engineering

The cumulative impacts to the leach pad heap and waste rock dump would be the same as stated under alternative 1, because it includes both Main and South Beal ore and waste.

The addition of the South Beal ore to the leach pad heap does raise some concern of the stability of the Gully fault slump in the main Beal pit, which is adjacent to the leach pad heap. The leach pad has been reconfigured to avoid impact from the slump. The slump has been stabilized by BMMI by dewatering the pit wall material. If the slump does move again the leach pad heap should not be affected unless the slump cuts into the mountain farther than predicted. Regardless of how the slump reacts in the future, the addition of South Beal ore to the heap will not worsen the consequences.

5. Consistency with the Deerlodge NF Plan

Alternatives 1 and 2 are consistent with the DNF Plan with regard to testing and handling of ore and waste from the South Beal pits. Alternatives 1 and 2 are also consistent with regard to ground stability concerns with the South Beal pits and haul road. Alternative 3 would not allow construction of the South Beal pits. Present operations are consistent with the Deerlodge Forest Plan with regard to testing and handling of ore and waste and ground stability.

B. Hydrology

The South Beal pits and any materials disposed of in the pit are a new and enlarged source under the Montana Water Quality Act nondegradation policy and therefore are subject to nondegradation provisions of surface and ground water rules. S. Beal waste rock and ore, both of which would report to existing permitted facilities, may not be subject to nondegradation because they are within the volume and rate of production (tons per year) established in the original DSL and USFS permit. Current operational problems with water quality at BMMI indicate that nonpoint sources of degradation such as sediment, nitrate, and sulfate, are not controlled with the use of BMMI's existing Best Management Practices or mitigations. BMMI is now undertaking studies to determine the sources of nitrate and sulfate in order to identify additional management practices for control.

1. Alternative 1 The South Beal Project

a. Ground Water

Direct and Indirect Effects:

Impacts to ground water from mining the South Beal deposit are expected to be minimal. The South Beal pits would only be open one year and would have a short-term effect on ground water. The water table under the proposed South Beal pits is 25 to 50 feet below the estimated levels of the pit floors, and ground water would not come in contact with backfilled waste from main Beal. No impact to groundwater from the South Beal pits is expected. The South Beal Monitoring wells will be used to verify that no degradation occurs. (Figure 3).

The South Beal pits would be backfilled with main Beal waste. No kinetic or static testing has been done on the main Beal waste. However, BMMI has committed to acid base accounting testing of the backfill material. The marble bedrock within the proposed pit floors would reduce the potential for acid rock drainage impacts to South Beal ground water.

There is an unresolved concern regarding sulfate release from main Beal wasterock, which would be used to backfill the pits. Water quality results from springs discharging below the main Beal waste rock dump indicate that main Beal waste may contribute sulfates to ground water. However, the sulfate source is uncertain. Potential sources include the use of mulch, dissolution of sulfate minerals, and oxidation of sulfides. If water infiltrates into the backfilled pits, sulfates could be produced and enter ground water. Successful reclamation would minimize any potential for impacts to ground water from release of sulfates. Reclamation and revegetation would reduce infiltration by increasing runoff and evapotranspiration.

Arsenic is contained in the South Beal deposit and is discussed in Chapter 3 of this EIS. Arsenic is least soluble in the near-neutral (pH 7) range, and becomes increasingly soluble if the pH decreases or increases. Solubility of arsenic within the South Beal deposit may increase if the pH of the ground water in that area deviates from near-neutral conditions. However, a change in pH sufficient to mobilize arsenic is extremely unlikely. (Please see geochemical discussion in this chapter.)

b. Surface Water

Direct and Indirect Effects:

Main Beal Waste Rock Dump

S. Beal waste will report to the Main Beal Waste Rock Dump. The concentration of nitrates and sulfates released from the waste rock pile may continue to increase with the addition of the South Beal waste, but the rate of their increase is not expected to change. The rate of material disposed on the waste rock pile would not change with the South Beal Project. The ultimate size of the waste rock pile would decrease slightly because approximately one million tons of waste from main Beal would be used to backfill the South Beal pits after mining is completed at South Beal.

Humidity cell tests indicate that South Beal waste would not be acid-generating. However, there is still a possibility of sulfate release from South Beal waste rock. Results from kinetic tests indicate that sulfate release would be expected to decrease through time. Any excess water would be pumped to a sump in the pit and used for sprinkling of the waste rock pile or for irrigation. This may increase nitrate and sulfate loads in springs below the waste rock dump, and possibly nitrate and sulfate concentrations.

South Beal Pits

If the South Beal pits do contribute nitrates to ground water, it would be at the same rate that nitrates are released at main Beal because the rate of blasting would be the same. The South Beal pits would be higher on the hillside above German Gulch than main Beal, and the pits would be smaller. Therefore, the potential that nitrates discharged to ground water, downgradient of the South Beal pits, would reach surface water in German Gulch is not great.

Impacts to aquatic communities from the South Beal pits would likely be minimal since these pits would not discharge to either ground or surface water. Ambient water quality would be maintained or pumped and treated. Increased chemical monitoring would ensure that nutrients, TDS, and metal concentrations do not increase above current levels. BMMI has not proposed an instream biological monitoring program for the South Beal amendment. Impacts from increased sediment or decreased surface water flows, as well as the impacts of the current operation on biological commonties would not be quantified.

Main Beal Heap

As discussed in the geology section of this chapter, sulfates are expected to be released from the South Beal ore, but pH of water is expected to remain neutral. If South Beal ore were to start producing acid or harmful effluent, BMMI has committed to a contingency plan, described in Chapter 2, that should effectively address the problems. The heap is part of a zero discharge circuit, and would not release any water to surface water.

Roads

The 600 feet of new road may contribute some sediment to German Gulch. The new road

is about 600' distance from German Gulch and any surface water runoff would be filtered through the forest. Properly applied BMPs should further minimize sediment delivery to German Gulch surface water.

2. Alternative 2 The South Beal Project with Modifications

a. Ground and Surface Water

Direct and Indirect Effects:

Increased frequency of data submittal, discussed in Alternative 2 in Chapter 2, during the mining of the South Beal deposit would allow the agencies to review monitoring reports while mining is ongoing. This would allow the agencies to respond to water quality changes should they become a problem during mine life in a more timely manner. If pH drops, potential remedial actions would include the addition of lime to the waste rock or capping of waste rock to prevent infiltration. Post-reclamation monitoring would verify that long-term impacts to water quality would not occur. Sulfate concentrations would be the same as discussed in Alternative 1. Nitrate concentrations in surface water would be lower than those discussed in Alternative 1 by mitigations #1 and #3a and 3b described in Alternative 2, Chapter 2.

If water quality analysis, including nitrate data, indicate that it is necessary, the agencies would review the mitigation plans BMMI uses pursuant to Section 337 of the Metal Mine Reclamation Act.

Biological monitoring stipulated by the agencies and discussed in more detail in Chapter 2, would help assessment of the current conditions and detect any impacts from the proposed expansion not effectively monitored by the current chemical monitoring program alone. The biological integrity of German Gulch would be assessed relative to background conditions. Biological monitoring would also document the effectiveness of BMMI proposed Best Management Practices (BMPs) to control nonpoint source pollution.

3. Alternative 3 The No Action Alternative

a. Ground Water

Direct and Indirect Effects:

The EA in 1988 determined that the development of the main Beal pit would have minimal impact on water quality and hydrologic relations in German Gulch. However, water quality has changed. Nitrate, sulfate and TDS levels have increased since mining began in 1988. Nitrate and sulfate levels have exceeded the drinking water standard in some monitoring wells. In monitoring wells SBB-87-07 and SBB-87-01, nitrate and sulfate concentrations may continue to increase even if South Beal is not permitted. As discussed under Alternative 1, nitrate and sulfate sources are not certain. The selection of the no action alternative would prevent any potential impacts from South Beal. However, the neutralizing waste rock from South Beal would not be available to cap the main Beal waste dump in case of waste rock acidification.

b. Surface Water

Direct and Indirect Effects:

The EA in 1988 determined that increased sediment production would have no measurable or long-term impact on German Gulch. However, water quality has changed. Concentrations of TDS, nitrates and sulfates have increased below the waste rock dump and pit. In monitoring wells SBB-87-07 and SBB-87-01, nitrate and sulfate concentrations may continue to increase even if

South Beal is not permitted. As discussed under Alternative 1, nitrate and sulfate sources are not certain. Nitrate concentrations have increased below the main Beal pit and waste rock dump. If Alternative 3, the No Action Alternative, is selected, the neutralizing waste from South Beal would not be available to cap the main Beal waste dump in case of acidification. BMMI is currently diverting approximately half the flow of surface water from above Spring 5. South Beal would not affect surface water flows. No biological monitoring is proposed under this alternative.

4. Cumulative Hydrologic Impacts for All Alternatives

a. Ground Water

If South Beal is approved, effects to ground water are expected to be minimal, as discussed in Alternative 1.

b. Surface Water

Potential cumulative impacts to surface water resulting from approval of all alternatives include increased sediment loading to German Gulch. If TDS, nitrates or sulfates are released from the South Beal pits or waste rock, they would be released at a similar rate to that which is currently occurring.

Nitrate concentrations have exceeded standards in Spring 5 downgradient of the waste rock dump. Possible sources include ANFO, fertilizer and slash and burn sites. Sulfate concentrations have exceeded drinking water standards in Spring 5 downgradient of the waste rock dump in 1992. If the water quality in Spring 5 remains above the standard and if South Beal waste rock releases any nitrates or sulfates at all, standards would continue to be exceeded under Alternative 1, and possibly to a lesser extent in Alternative 2. Implementation of Alternative 2 mitigations should eliminate WQB violations.

German Gulch flows into Silver Bow Creek which then becomes the Clark Fork River downstream of the Warm Springs Ponds. Currently elevated metals impair beneficial uses in about 150 miles of the upper Clark Fork and Silver Bow Creek (Ingman and Kerr, 1990 and DHES, 1992). Approximately 100 miles of the upper and middle Clark Fork Rivers are also impaired due to nutrient pollution resulting from elevated concentrations of nitrogen and phosphorus (Ingman and Kerr, 1989a and DHES, 1992). Dense algal mats reduce dissolved oxygen levels in the river, impair aesthetic and recreational qualities and impede irrigation.

Nitrate concentration have increased in German Gulch, based on BMMI monitoring, relative to pre mine conditions. Limitations of the current monitoring program preclude accurate assessment of the relative contribution of nitrogen from the mine to the Clark Fork River. However, based on pre-mine and 1991 monitoring nitrate concentration and monthly flow, the nitrate load from German Gulch has increased from 24.4 to 1,116.6 pounds per year. These concentration represent an increase from .017 percent to .78 percent of the total nitrogen load of Silver Bow Creek between Ramsey and the Warm Springs ponds. Modification of current practices and implementation of BMP should reduce this nitrogen load.

Silver Bow Creek and the upper Clark Fork River contain abundant algal growth, caused in part by nitrate loading. Silver Bow Creek, between Ramsey and Warm Springs, carries an estimated annual load of 142,454 lbs nitrate. (Ingman, 1992). Data from Station 3A indicate that upper German Gulch's contribution to the nitrate load in Silver Bow Creek has increased from 0.017 percent to 0.78 percent (in 1991) since BMMI began operations. Preliminary 1992 data indicate that nitrate loads in German Gulch have continued to increase.

BMMI has an ongoing exploration program in the mine vicinity which has cumulative impacts with main Beal, and would have cumulative impacts with South Beal. This program

includes drilling, trenching, and access road construction. All of this activity increases the sediment producing potential within the drainage. Proper road design, construction and maintenance techniques would assure that cumulative impacts from exploration would be minimal.

5. Consistency with the Deerlodge NF Plan

Alternative 1 may not be consistent with DNF plan. Alternative 2 is consistent with the Deerlodge Forest Plan with regard to protection of and impacts to ground and surface water. Alternative 3 would involve no work at the South Beal site. Ongoing activities are consistent with the Deerlodge Forest Plan with regard to protection of and impacts to ground and surface water.

C. Wildlife

Biodiversity: This section examines the impacts that the proposed action and the other alternatives will have on biological diversity of the Beal Mountain Mine area. Direct, indirect, and cumulative effects on wildlife are analyzed. The analysis of cumulative effects for this project will take in the past, present, and foreseeable actions occurring in the German Gulch area (Table IV-1). For landscape analysis, other projects within the Fleecer range may also be included.

Table 4.1 Past, Present, and Foreseeable Actions in the Beal's Hill Area

ACTION	LOCATION	ACRES	YEAR	METHOD
Beal Mtn Mine	German Gulch	425	1988	Open Pit/Roads Heap Leach
Mining Exploration	German Gulch	50	89/90	Road Building
Mining Exploration	German Gulch		91/92	Road Building
South Beal Expans.	German Gulch	25	1993	Open Pit/Roads
Mining Exploration	German Gulch	?	1993	Road Building
Mining Exploration	American Gulch	?	1993	Road Building
Beal Extension	German Gulch	?	1994?	Deepening of Pit

1. All Alternatives, Biodiversity

a. The Fleecer Mountain Complex

Direct and Indirect Effects

The action alternatives will remove about 25 acres of lodgepole-dominated habitat from a north-facing slope. This is a slight and temporary shift from mature lodgepole pine forest to a seedling/sapling site 2 years after mining in Alternative 2, or a permanent loss of 25 acres of lodgepole in Alternative 3. In either case this action alone would not affect the landscape pattern of the Fleecer Range.

b. German Gulch Landscape Patterns

Direct and Indirect Effects

The pit would be backfilled and revegetated in Alternatives 1 and 2. The site would be temporarily converted to a seedling/sapling stand and eventually return to the current state. Alternative 3 (No Action) would not convert the timber on this slope. However, as discussed in the existing environment in Chapter 3, the existing exploration roads would still compromise the site for wildlife habitat. Alternative's 1 and 2 would not alter local landscape patterns, and Alternative 3 would maintain a roaded layout on the landscape that is not a natural pattern at all.

c. Regional Linkages

Direct and Indirect Effects

Neither of the action alternatives alone will have an effect on habitat linkages.

d. Edges

Direct and Indirect Effects

The action alternatives will not change the typical edge pattern of the Fleecer Range. An abrupt structural edge will be created in both cases. Alternative 1 and 2 will result in an abrupt edge temporarily, gradually blending back into the unaffected landscape as the planted trees mature. Alternative 3 would not leave the exploration roads on the site and the high density of unnatural edge would be restored to a more natural condition over time. The wildlife value of this hillside would not be adversely impacted as a result. These roads would be obliterated and restored regardless of the outcome of this project.

e. Riparian Areas and Associated Species Including MIS

Direct and Indirect Effects

This proposed project will destroy some forested wet areas that are less than an acre in total size. The loss of these sites may have impact on species with low mobility but will have little effect on species that are able to leave the area. The wet areas along the hillside are currently compromised by the high density of exploration roads that crisscross the site. In-stream effects in German Gulch are covered in the fisheries and watershed sections.

f. Lodgepole Pine/Douglas-fir and Associated Species Including MIS

Direct and Indirect Effects

Both action alternatives will remove about 25 acres of mature lodgepole pine habitat. Alternative's 1 and 2 will temporarily convert the site to a seedling/sapling stand one year after mining. These alternatives will also enhance the current condition of the hillside by obliterating the exploration roads and replanting them. Lodgepole pine is an abundant species throughout the area and this project will reduce this component in timber compartment 406 from 7,244 acres to 7,218 acres - a loss of 0.4 percent. This project should not likely affect hairy woodpeckers or other species that use lodgepole pine forests. This is in part due to the condition of this stand, the quality of which has already been compromised by the high density of exploration roads in place.

g. Old-growth and Associated Species Including MIS

Direct/indirect Effects

There are no effects on old-growth as a result of the action alternatives.

h. Grassland and Associated Species Including MIS

Direct and Indirect Effects

There are no effects on grasslands as a result of the action alternatives.

2. All Alternatives, Specific Species of Interest

a. Elk

Direct and Indirect Effects

Both action alternatives remove 25 acres of cover for elk. This reduces the cover calculation for EUP from 39.5 percent to 39.4 percent, but EEC would remain at 81 percent (Table IV-2). However, since this area is closed to elk hunting this model does not accurately reflect impacts on elk in this instance. More important to elk survival is whether this action displaces elk outside of the security area (i.e. permit boundary) and into areas accessible to hunters. It is unknown whether this disturbance will be sufficient to move elk out of the boundary, but elk will be displaced off the hillside during the hunting season. For Alternatives 1 and 2, this will be a temporary condition because the pits will be backfilled and the roads will be reclaimed. Reclamation will create a grassy opening until the seedling trees begin to grow. Elk will not likely be adversely affected by either action alternative.

Table 4.2 Hiding Cover and Road Density Calculations for the High Rye EHROGA - Beal Mountain Mine Analysis

EHROGA	ACREAGE	% HIDING COVER	% ELK USE POTENTIAL	TOTAL ROAD DENSITY (mi/sq.mi)	OPEN ROAD DENSITY (mi/sq.mi)	% ELK EFFECTIVE COVER
Action Alternatives	26, 470	39.1	100	1.2	0.4	81
Existing High Rye	26,470	39.5	100	1.2	0.4	81
Minimum Forest Plan Standards	—	36	95	no standards	0.5	70

b. Mule Deer

Direct and Indirect Effects

Both action alternatives will displace mule deer from the hillside. However adequate habitat exists on the perimeter of the permit boundary and on the outside of the boundary for mule deer to occupy. This action will not adversely affect mule deer.

c. Blue Grouse and Spruce Grouse

Direct and Indirect Effects

Both action alternative may remove winter habitat for these species. However large areas of habitat are available in all directions from the mine site. This action will not likely adversely affect either of these species

d. Threatened, Endangered, and Sensitive Species

Potential effects from all three alternatives, on threatened, endangered, and sensitive species are summarized briefly here (Table 4.3).

Table 4.3 Summary of Effects on Threatened, Endangered, and Sensitive Wildlife Species Observed or Believed Likely to Occur in the Beal's Hill Area

SPECIES	STATUS	ALT. 1	ALT. 2	ALT. 3
Peregrine Falcon	E	NLAA	NLAA	NE
Bald Eagle	E	NE	NE	NE
Lynx	C2/S	NLAA	NLAA	NE
Boreal Owl	S	NLAA	NLAA	NE
Fisher		NE	NE	NE
Flammulated Owl	S	NLAA	NLAA	NE
Townsend Big-eared Bat	C2/S	NLAA	NLAA	NE
Black-backed Woodpecker	S	NE	NE	NE

Effects Notation:

NE	no effect
NLAA	not likely to adversely affect
MAA	may adversely affect
BE	beneficial effect

Status Notation:

S	sensitive species
E	endangered species
T	threatened species
C2	category-2 candidate species

An "effect" under the Endangered Species Act (1973) is a result that would (1) jeopardize the continued existence of a threatened or endangered species or (2) adversely modify its habitat. The Forest Service Manual (FSM 2672) extends these criteria to sensitive species as well, and adds the condition that viable population levels be maintained.

In Table 4.3, the agencies determined that an alternative would have "no effect" if (1) suitable habitat was not being eliminated or radically modified, (2) the species was assumed not to be present in the project area, (3) human disturbance during mining operations was highly unlikely to affect species behavior or habitat use, or (4) no increase in human disturbance was expected as a result of the project. The agencies concluded that an alternative was "not likely to adversely affect" if (1) suitable habitat was affected, but replacement habitat was readily available, (2) no key habitat components were radically modified, (3) the species was likely to be able to adapt behaviorally to disruption during mining, or (4) not enough information was available to reach a conclusion of "no effect" with reasonable certainty.

3. All Alternatives, Cumulative Wildlife Impacts

a. The Fleecer Mountain Complex

Within the 50,000-acre landscape of the Fleecer Range this action is one more small project that gradually alters the character of the entire area. Either action alternative, in and of itself, will not affect the landscape. However, in connection with all the projects that have occurred within the Fleecer Range, the landscape has changed. Roads are constructed in most of the major drainages, including German Gulch. Many of the streams/riparian zones have been modified by mining and cattle grazing. Alternative's 1 and 2 would have a temporary impact on the German Gulch hillside. In connection with the existing mine, this action widens the area of impact at the head of German Gulch while the disturbance occurs.

b. German Gulch Landscape Patterns

This project, in addition to the existing mine, does alter the local landscape pattern. Approximately 400 acres do not resemble any natural landscape feature or pattern that originally existed. The configuration of vegetation at the head of this drainage has been altered and at least part of the area (main Beal pit, old-growth stands) can not be rehabilitated to pre-project patterns in the short-term.

c. Regional Linkages

The existing mine has had an impact on wildlife movements. It has altered the movement pattern of elk that use this area. During the hunting season this area is used as a security site and during calving season elk must find alternative sites to give birth. Wildlife moving up the drainage as an avenue into the Fleecer Range must skirt around the headwaters area which is directly impacted by mine activities. Habitat on either side of this drainage is suitable to absorb species movements and a linkage between or among habitats is not completely blocked because of these activities.

Migratory birds are not likely to be affected and probably would avoid the site. However, there is a possibility that they may be attracted to the holding ponds. No incidences of such occurrences have been reported. If birds ever are attracted to the holding ponds mitigation measures such as netting over the ponds should ensure that birds do not land on them.

d. Edges

A discussion of edges and their importance is contained in chapter 3. The mine itself has obliterated the edge pattern between an open grassland park and the forested stringers surrounding it. It has not invaded interior habitats in a substantial way, and after reclamation, the edge pattern of the area, although different, will not be out of the range of variation for the eastside Rocky Mountains. The exploration roads have invaded forested stands and are widening the "edge effect" around the mine site. This is currently true for the stands to the east of the mine and to the south. Future exploration into the American Gulch area may further invade interior habitats if road building and tree removal are included.

e. Riparian Areas and Associated Species Including MIS

German Gulch was impacted by historic mining prior to the start of the existing mine. The current mine has removed about 4 acres of streamside vegetation, mostly by road construction. The original EA states that the area the leach pad now occupies contained many seeps and springs (USFS 1988, p.44). This type of habitat is very attractive to wildlife in a juxtaposition with cover and forage. The current mine activity has rendered approximately 190 acres of grasslands with scattered wet areas and forested stringers permanently unavailable for species that require or select for wet meadow type sites (such as the Western Jumping Mouse).

The Greenland Gulch drainage to the south and the Beefstraight Gulch drainage to the north have suitable riparian habitats available to wildlife. Greenland Gulch is remote and relatively untouched. Beefstraight has been impacted by mining and livestock grazing but still contains adequate shrubby riparian sites to attract wildlife species that require that type of habitat. Small wet meadow openings (less than 10 acres) are scattered throughout both drainages.

f. Lodgepole Pine/Douglas-fir and Associated Species Including MIS

The existing mine has eliminated about 130 acres of lodgepole pine and Douglas-fir habitat. This is about 1.5 percent of the lodgepole pine/Douglas-fir component of timber compartment 406 (Lodgepole pine = 3,890 acres, Douglas-fir = 739 acres). An additional 37 acres of old growth Douglas-fir habitat and 40 acres of lodgepole pine habitat has been impacted by exploration roads (Exploration EA, 1992). Proposed exploration into the American Gulch area will impact additional forested habitat. While roading does not remove the entire timber stand it does change the character of the stand and the wildlife species that use it.

g. Old-growth and Associated Species Including MIS

The connected actions of this project include the exploration roads that radiate from the mine center. Several of these roads extend to the east of the mine and dissect a 37-acre

Douglas-fir old-growth stand (Exploration EA 1992). The quality of this patch is currently lessened and the loss of this stand reduces the estimated Douglas-fir old-growth component of Compartment 406 from 174.45 acres to 137.45 acres, a decline of 21 percent. Most of the large old trees were avoided during road construction in the event that the roads would be obliterated and the stand could recover an unentered quality sooner than if they were removed. If the exploration discovers a minable ore body, this stand will be completely removed. An estimated 23.6 percent of the Douglas-fir in timber compartment 406 is old-growth. The removal of this stand reduces that percentage to 18.6 percent, and the total old-growth component for the timber compartment from 9.6 percent to 9.0 percent. This is within the forest plan standard that requires 5 percent of each third order drainage to be old-growth.

This stand represents the only area within the permit boundary that is suitable as goshawk foraging and nesting habitat. However, the exploration roads have probably made this unavailable for the present. Available sites outside the boundary are located especially in the Greenland Gulch area which contains a large unfragmented block of forested habitat (>5,000 acres).

Exploration into American Gulch would impact approximately 40 acres of old-growth spruce/subalpine fir habitat in the upper end of the drainage. Adverse impacts to this stand would be expected if road construction and exploration were conducted.

h. Grassland and Associated Species Including MIS

The existing mine removed about 133 acres of high elevation meadow. This habitat is no longer available to grasslands species. Reclamation after the mine life should restore part of this site however, in the short-term, the vegetative species mix will not resemble the composition on the site before the mine. Exploration has not seriously impacted grassland sites.

Montane voles do not occupy the impacted habitat however it is likely that they occupy the remaining grasslands within the permit boundary.

4. All Alternatives, Cumulative Impacts to Specific Species of Interest

a. Elk

The EA for the original mine (1988) predicts that the existing mine "... has the potential to displace elk and stress wintering animals." It also states that "The calving area on top of Beal's Hill will be eliminated and the suitability of the area as calving habitat [will be] severely impacted after mining....Elk migrations will be affected by the human activity on Beal's Hill." No specific monitoring of the elk herd has been conducted to determine how this disturbance has affected it. However, it is known that: elk calving has shifted from the Beal's Hill area, elk do use the permit area as a refuge during the hunting season, elk do not appear to be more stressed during the winter (in part due to mitigation measures), and the productivity of the herd has not declined (M. Frisina, pers. comm. 1993). It is unknown where elk calving now occurs or how transitory animals react to the disturbance. The additional disturbance of the South Beal Project added to the current disturbance of the existing mine and exploration should not likely adversely affect the elk herd.

b. Mule Deer

Mule deer have been displaced from the impacted acres of the current mine and exploration sites. However they have habituated to the activity to some degree and are commonly observed around the perimeter of the mine site. The mule deer population has not been adversely affected by the past action and future actions, although impacting more habitat, will not likely adversely affect this species.

c. Blue Grouse and Spruce Grouse

The existing mine has affected distribution of blue and spruce grouse in this area. The leach pad is situated on a brooding area and destroyed about 186 acres of habitat. The birds had to find alternative sites for brood-rearing, but there have been no monitoring efforts to discover their fate. It is unknown how the mine has affected the grouse population in the area. The outward spreading of the mine with the proposed action and the current and future exploration continues to remove available habitat from the head of German Gulch. Habitat to the north and the south is still relatively intact and could provide refuge for those individuals displaced from German Gulch. It is unknown how these activities have affected seasonal migration of these birds.

5. Consistency with the Deerlodge NF Plan

All alternatives are consistent with the Deerlodge National Forest Plan with regard to protection of and impacts to wildlife.

D. Fisheries

1. Alternatives 1 and 2, The South Beal Project

Direct and Indirect Effects

Construction for the 600-foot access road to the South Beal pits should not add additional sediment to German Gulch Creek if proper BMPs are used and maintained. The location and short length of the road and application of BMPs should reduce potential sediment delivery to a minimum.

If BMPs are not maintained, sediment could be contributed to German Gulch. Sediment in this area is mineralized, therefore toxic elements derived from these sediments accumulate in the food chain and have the potential to adversely impact periphyton macroinvertebrate and fish.

2. Alternative 2 The South Beal Project with Modifications

As discussed in the surface water hydrology portion of this chapter, increases in nitrates, sulfates, and TDS may continue under this alternative. The levels of these substances at water quality monitoring sites in German Gulch Creek are below standards and become diluted with increasing distance downstream. Existing levels are not expected to adversely affect fish populations in German Gulch. However, there has been some impairment of the periphyton community at Station 3A. Additional increases in these parameters may further affect the aquatic periphyton communities and aquatic microinvertebrate populations, which, over time, may adversely affect fish populations in the upper reaches of German Gulch.

Additional requirements included in Alternative such as increased frequency of reporting, and adjustments in applications of fertilizer on reclaimed areas will allow for increased involvement and response of agency personnel should water quality changes occur. These requirements would allow for coordinated input for all affected resources to apply measures to reduce or mitigate effects should water quality changes occur. The post reclamation monitoring would verify that long-term impacts to water quality would not occur.

3. Alternative 3 The No Action Alternative

The No Action Alternative would prevent any potential impacts from South Beal. The 600 feet of access road to the South Beal pits would not be constructed. Nitrate and sulfate levels may continue to increase. Because this alternative does not include the biological monitoring proposal, possible impacts to the aquatic community of German Gulch may not be quantified. Additional diversion of flows from Springs 3 and 5, if necessitated by water quality concerns, may reduce

winter habitat capability upstream of Station 2A.

4. Cumulative Fisheries Impacts for All Action Alternatives

Road construction activities for mine operation and exploration have occurred, and additional exploration construction is expected to continue. The cumulative impacts of road construction have been addressed in the EA for the 1992 BMMI Exploration Project by placing an upper limit on the amount of erodible project area road surface. The new haul road constructed in 1992 crosses the upper end of German Gulch Creek. Although BMP's were to be applied during construction of this road, sediment delivery to the stream was apparent during the MDHES Water Quality Bureau inspection in July 1992. Incorporation of stormwater permit BMPs and new BMPs discussed in Alternative 2 in Chapter 2 could assure sediment problems identified with ground disturbing activities are addressed promptly and effectively.

In response to increased nitrates observed within the permit boundary, BMMI constructed collection facilities at Springs 5 and 3 to allow for diversion of this water into the process water system, if required due to water quality concerns. These springs contribute surface flow directly to German Gulch. Partial diversion of water at Spring 5 occurred during 1992. Flows from Spring 5 contribute up to 30 percent of discharge at water monitoring Station 3 on German Gulch, during low flow months. The partial diversion of Spring 5 flows (approximately 20-30 gpm) is estimated to reduce flows at Station 3 by less than 5 percent during low flow periods and should not affect German Gulch fish populations. However, if additional water quality concerns necessitate complete diversion of flows from Springs 5 and 3, the cumulative reductions in flow in German Gulch may reduce winter habitat capability upstream of Station 2A (approximately 1 mile below the permit boundary).

The additional requirements included in Alternative 2 will allow for closer monitoring of changes in water quality and potential effects to German Gulch. If water quality changes occur at Springs 5 and 3, the additional water quality data and increased involvement of agency personnel would allow for balancing water quality concerns, water quantity concerns, and concerns to fisheries when addressing diversion of Spring flows. A balance of concerns would reduce potential impacts to winter fish habitat in German Gulch.

5. Consistency with the Deerlodge NF Plan

Alternative 1 may not be consistent with the Deerlodge National Forest Plan. Alternatives 2 and 3 are consistent with the Deerlodge National Forest with regard to protection of and impacts to fisheries.

E. Resources With No Significant Impacts

Please see summary of these resources in Chapter 3.

F. Commitment of Resources

Selection of Alternatives 1 and 2 would result in the mining of the South Beal pits and would be an irreversible and irretrievable commitment of 959,840 tons of ore which would be removed from the South Beal pits and placed on the main Beal leach pad. Irreversible and irretrievable commitment of resources from Alternative 3 are discussed in the 1988 EA.

CHAPTER V CONCLUSIONS

Review of the proposed South Beal Project resulted in the identification of four general issues.

A. Geology and Engineering

What is the potential for the mine material to produce contaminated leachates?

The rocks associated with the South Beal deposit contain some sulfides, so there is some potential for acid rock drainage. However, it is not expected to occur. BMMI has proposed a rock monitoring program which would allow the company and the agencies to predict problems with acid rock drainage and to prevent drainage of contaminated leachates from becoming a serious problem at Beal. BMMI has committed to address the problem if the heap leach produces acid. BMMI must monitor the interior of the waste dump to help distinguish potential sources for the existing sulfate concentrations. BMMI would also implement additional testing if the agencies determine it is necessary. The agencies would have more data to predict and define the potential for contaminant leaching.

If Alternative 3 is selected, BMMI's commitment to address acid rock drainage from the heap would not be included. If contaminated leachate were to become a problem, the agencies could review BMMI's reclamation plan for main Beal under Section 337 of the Metal Mine Reclamation Act. Also, if contaminated leachate occurs, the marble waste rock from the South Beal waste rock would not be available to cap acid producing rock from main Beal. Any possibility for contaminated leachate from South Beal ore or waste rock would be eliminated if Alternative 3 were selected.

Would the South Beal pits be stable? If they fail, would the area to be reclaimed be larger?

Although stability of the pits is a concern, BMMI has proposed several mitigating measures to reduce or eliminate the possibility of pit wall failure. BMMI's commitments, included in Alternatives 1 and 2, are fully described in Chapter 2 and the analysis of their effectiveness is in Chapter 4. Selection of Alternative 3, the no action alternative, would eliminate any possibility of South Beal pits instability because the South Beal pits would not be mined.

Because of operational stability problems in the main Beal pit, would the addition of ore on the heap affect the stability of the heap and/or pit?

The addition of 1 million tons of South Beal ore in Alternatives 1 and 2, on the main Beal heap would not affect the stability of the heap or pit.

If Alternative 3 were selected, no South Beal ore would be placed on the heap. Stability concerns would still be present for the heap and main Beal pit.

B. Ground and Surface Water

Would the proposed action affect water quantity? Would the proposed action affect ground and surface water quality in the German Gulch drainage? What is the potential for acid rock drainage and what effect would acid rock drainage have on water quality?

Impacts to ground water from implementation of Alternative 1 and 2 are expected to be minimal. Implementation of Alternative 1 may result in an increase of nitrates and sulfates but the changes would be at the same rate as current levels. Alternative 2 should result in smaller increases of nitrates.

If Alternative 1 were selected, BMMI would submit water quality monitoring results from South Beal annually along with water monitoring reports from the main Beal operation. Alternative 2, the South Beal Project with modifications, proposes that water quality monitoring reports would be supplied to the agencies monthly. This would increase agency and company oversight of problems associated with water quality and allow the agencies and company to take action on water quality problems during the mining of the South Beal deposit.

BMMI has committed to BMPs to control erosion and sedimentation at both the main Beal pit and the South Beal pits. The agencies included several nitrate BMPs in Alternative 2, the South Beal Project with modifications. If Alternative 3, the no action alternative, is selected, the agencies will evaluate BMMI's BMPs this field season and, if warranted, will modify BMMI's permit.

Would the proposed action affect water quantity? The index of measure will be flow rate. Would the proposed action affect ground and surface water quality in the German Gulch drainage? Specifically, how would the proposed action affect sediments and concentrations of Total Suspended Solids (TSS), Total Dissolved Solids (TDS), nitrate, sulfate, arsenic and other metals? Indices of measure will be concentrations of the parameters listed above.

What is the potential for changes in water quality, such as, an increase in the concentration of nutrients, suspended sediment and metals, or changes in pH, to adversely affect beneficial uses of surface water in German Gulch? Under Montana's Water Quality Act (MWQA) these beneficial uses are protected. Uses that may be adversely affected are: growth and propagation of salmonid fishes and associated aquatic life (plant and invertebrates): and, aesthetics and recreation qualities. Reduction of flow may also adversely affect water quality and hence beneficial uses.

In cases were numerical criteria are not available, such as nutrients and sediment, impacts to beneficial uses are assessed through monitoring of instream biological (plant and invertebrate) communities. Changes in abundance, community structure and function, reduction of taxa and dominance of the aquatic community by a few taxa, are indices of the degree of impairment of these beneficial uses. When numeric standards have been adopted for particular uses, such as for aquatic organisms or human health, these criteria are used to assess protection of use in addition to the community metrics.

C. Wildlife

Wildlife concerns specific to the implementation of the South Beal Project include questions about additional habitat modification, displacement of animals, and cumulative effects with existing mining disturbance. Secondarily, if displacement were to occur, what indirect effect to the Fleecer Landscape wildlife and habitat could be expected?

The action alternatives would have short-term effects on wildlife habitat and wildlife.

D. Fisheries

How would the proposed action affect fish habitat?

Increases in concentrations of nitrate and sulfate under Alternative 1 may further affect the aquatic periphyton communities which are already moderately impaired. Over time this may affect fish populations in upper German Gulch. Implementation of mitigations in Alternative 2 would result in smaller concentrations of nitrate and sulfate and less impact to fish populations.

Under Alternative 3, BMMI would continue to direct flows from German Gulch which may adversely affect winter habitat capability upstream of Station 2A. BMP update would result in smaller impacts to water.

Table 5.1 Comparison of Disturbance for Alternatives 1, 2, and 3

Disturbance	Alternatives 1 and 2	Alternative 3 No Action
Road Length	500-600 feet	No Change
Permit Area	1202.2 acres	1202.2 acres
Total Disturbance	450 acres	425 acres

Although the total number of acres disturbed would increase from 425 acres (Alternative 3) to 450 acres (Alternative 2), the cumulative impacts from the proposed action are considered to be minor. Backfilling of the South Beal pits with waste rock from the main Beal pits would allow reclamation of what would otherwise be an unstable open pit.

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State Historic Preservation Office
Montana Department of Health and Environmental Sciences Air Quality Bureau
Montana Department of Health and Environmental Sciences Water Quality Bureau

GLOSSARY

2:1	Slope angle measurement expressed as a ratio of horizontal distance to vertical distance; For example, the slope is twice as long horizontally as vertically; 2:1 = 27°
ABA	Acid Base Accounting
ANFO	Ammonium nitrate/fuel oil - a blasting agent
alkaline	having a pH greater than 7
ANP	Acid Neutralizing Potential
APP	Acid Producing Potential
AQB	Air Quality Bureau
BMMI	Beal Mountain Mining Incorporated
concentration	amount of material contained in a specified volume, or the strength of a solution (mass per volume)
degradation	the increase in concentration of certain regulated substances above background levels. This may only be allowed by the BHES based on necessary social and economic concerns.
DHES	Department of Health and Environmental Sciences
DNF	Deerlodge National Forest
DSL	Department of State Lands
EA	Environmental Assessment - an environmental document of a proposed action and its effects on the environment.
EIS	Environmental Impact Statement
EPA	Environmental Protection Agency
fault	a break in the continuity of a rock formation, caused by shifting of the earth's crust.
gpd	gallons per day
gpm	gallons per minute
igneous rocks	rocks formed by solidification from a molten or partially molten state.
lcy	loose (unpacked) cubic yard
leachate	liquid that has percolated through soil or other medium.
MCA	Montana Code Annotated

MMRA	Montana Metal Mine Reclamation Act
metamorphosed	altered in composition, texture or internal structure, principally by heat, pressure, and introduction of new chemical substances.
mg/L	milligrams per liter
mm	millimeter
oxidation	the combination of a substance with oxygen
ore	a mineral or group of minerals from which a valuable material (usually a metal) can be profitably mined or extracted.
pH	measure of the acidity or alkalinity; 7 is neutral, low numbers are acidic.
PER	Preliminary Environmental Review, precursor to the Environmental Assessment
shear zone	a zone in which shearing has occurred on a large scale so that the rock is crushed and brecciated.
sulfide	referring to a mineral which is a compound of sulfur with more than one element.
WQB	Water Quality Bureau, Department of Health and Environmental Sciences

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APPENDIX A - PLANT BIOLOGICAL EVALUATION

PLANT BIOLOGICAL EVALUATION FOR SOUTH BEAL PROJECT

March 15, 1993

BIOLOGICAL EVALUATION - SENSITIVE PLANT SPECIES

Beal Mountain Mine Proposed Expansion

INTRODUCTION

It is Forest Service policy to protect the habitat of federally listed threatened and endangered species, and Forest Service designated sensitive species, from adverse modifications or destruction, as well as to protect individual organisms from harm or harassment. This Biological Evaluation is the method used to evaluate impacts on threatened, endangered, and sensitive plant species due to the proposed action.

PROCESS

The Biological Evaluation is a five-step process consisting of pre-field review, field reconnaissance, conflict determination, analysis of significance, and biological investigation. Evaluation of impacts on a given species may be complete at the end of step 1 or may extend through step 5.

PRE-FIELD REVIEW

This review is necessary to determine which plant species may be present within the project area. Based upon past projects in the vicinity, a review of the Montana Natural Heritage data base, and previous searches, the following statements can be made: There are no known federally listed plant species in the South Beal Project area. Federal listing refers to Threatened and Endangered species on record by the U. S. Fish and Wildlife Service. Additionally, there are no known sensitive plant species in the South Beal area.

The sensitive plant species on the Deerlodge National Forest list that has been found within the project area of the Beal Mountain Mine is listed below:

Scientific Name:	Juncus hallii
Common Name:	Hall's rush
Status:	Deerlodge SS

BACKGROUND INFORMATION ON HALL'S RUSH

Juncus hallii has been found on Beal Hill and has been reported in upper Basin Creek. Habitat is wet to dry meadows in montane to subalpine zones.

The South Beal proposed expansion area does not have habitat suitable for Juncus hallii. Therefore, the probability of finding sensitive plant species is extremely remote.

The one sensitive plant species that needs a forest environment and has the best potential to be in the South Beal area is Allotropa virgata. The large amount of lodgepole pine in the area would be an obvious place to search. The soils and vegetation may be appropriate but the slope and aspect are not, and thus habitat for that species is not right and the plant was not found.

FIELD RECONNAISSANCE

Foot surveys were conducted in 1992 to look for sensitive plants within the expansion area. No sensitive species were found in the area.

More specifically concerning Allotropa virgata, most of the lodgepole pine forests in South Beal area are too moist for this species. The sites have too much competing vegetation, soils are not granitic, and trees are too densely stocked. Therefore surveys did not reveal any Allotropa virgata.

CONFLICT DETERMINATION

Since no sensitive plant species were found, there will not be any conflict with either the habitat or any sensitive plant species from the proposed timber removal and pit development.

DETERMINATION OF EFFECTS

Implementation of this project as proposed will have no negative impact on any of the species listed above.

RECOMMENDATIONS FOR MITIGATING ADVERSE IMPACTS

If future surveys find sensitive plant species in the proposed area, measures will be taken to ensure that the species and their habitats are protected.

PREPARED BY

John W. Joy - Forest Ecologist